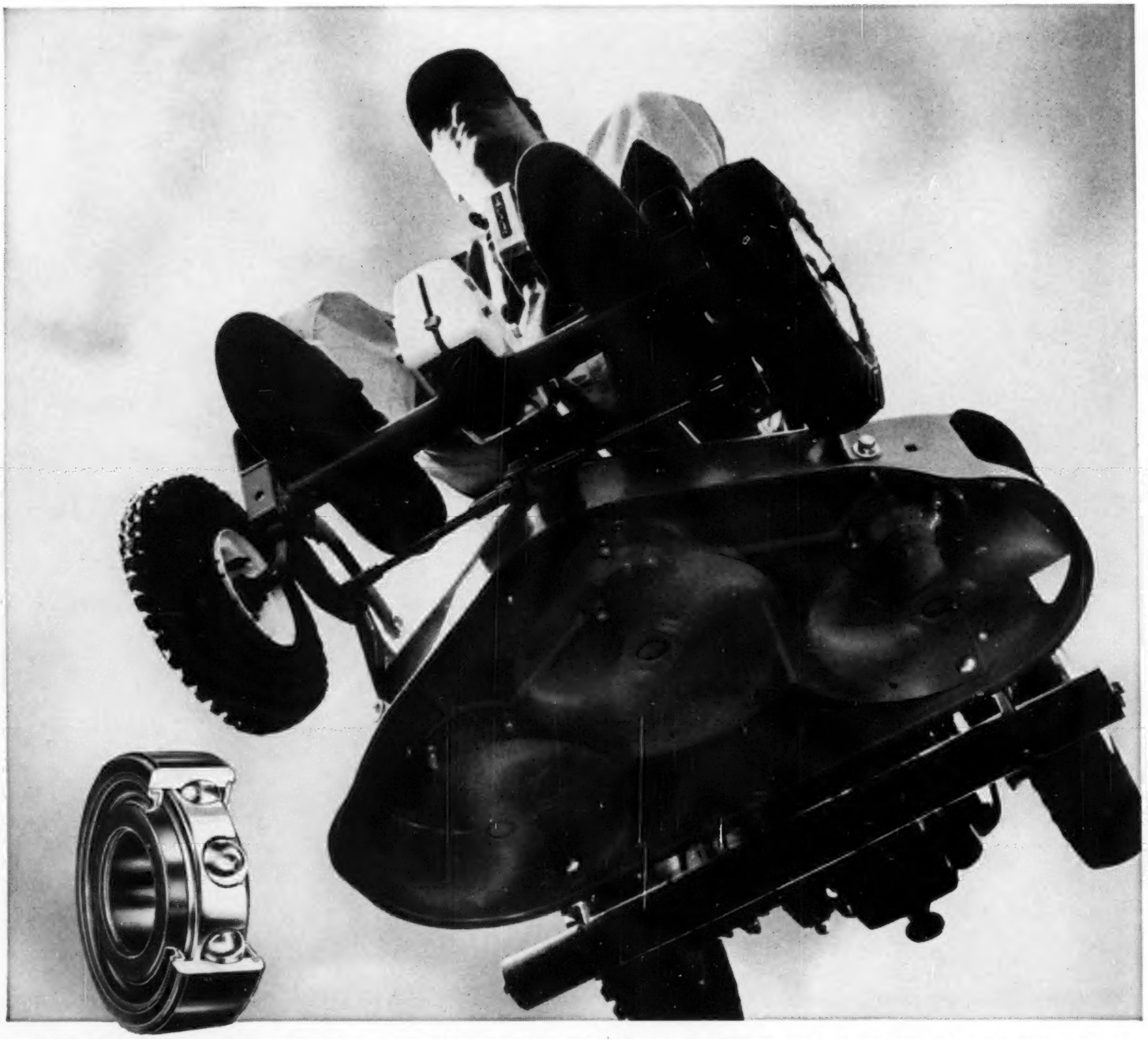
AUGUST 1961

Agricultural Engineering

The Journal of the American Society of Agricultural Engineers

NEW DEPARTURE CASE HISTORY

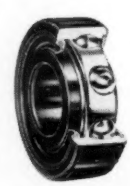


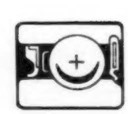
HOW N/D BALL BEARINGS REDUCE MOWER MAINTENANCE AND PRODUCTION COSTS!

PROBLEM: Manufacturer of well-known power lawn mower wanted to make unit more maintenance-free.

SOLUTION: Complete re-evaluation of all rotating parts including a study of rotary blade bearings by N/D Sales Engineer. His recommendation: Replace six existing non-integrally sealed bearings with lubricated-for-life New Departure ball bearings. These factory greased bearings are equipped with integral Sentri-Seals* and Land-Riding Seals. Results: Greater consumer sales appeal by doing away with the need for relubrication maintenance. In addition, N/D's compact ball bearings reduce production cost by eliminating separate bearing seals and six unnecessary grease fittings.

If you're designing new products involving bearings, invite a N/D Sales Engineer to your next design discussion. His knowledge of bearing engineering may result in a savings and valuable new product sales features. Contact him at your local N/D Sales Engineering Office, or call or write New Departure, Division of General Motors Corporation, Bristol, Connecticut. *New Departure Registered Trade Name.





Integrally sealed N/D ball bearings eliminate need for relubrication, grease fittings and separate seals. These heavy-duty N/D bearings with Sentri-Seals* and Land-Riding Seals, shut out moist or dry contaminants.

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Agricultural Engineering

Established 1920

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Note: AGRICULTURAL ENGINEERING is regularly indexed by Engineering Index and by Agricultural Index. Volumes of AGRICULTURAL ENGINEERING, in microfilm, are available (beginning with Vol. 32, 1951), and inquiries concerning purchase should be directed to University Microfilms, 313 North First Street, Ann Arbor, Michigan.

AGRICULTURAL ENGINEERING is owned and published monthly by the American Society of Agricultural Engineers. Editorial, subscription and advertising departments are at the central office of the Society, 420 Main St., St. Joseph, Mich. (Telephone: YUkon 3-2700).

JAMES BASSELMAN, *Editor and Publisher*

SUBSCRIPTION PRICE: $8.00 a year, plus an extra postage charge to all countries to which the second-class postage rate does not apply; to ASAE members anywhere, $4.00 a year. Single copies (current), 80¢ each.

POST OFFICE ENTRY: Entered as second-class matter, October 28, 1933, at the post office at Benton Harbor, Michigan, under the Act of August 24, 1912. Additional entry at St. Joseph, Michigan. Acceptance for mailing at the special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized August 11, 1921.

The American Society of Agricultural Engineers is not responsible for statements and opinions advanced in its meetings or printed in its publications; they represent the views of the individuals to whom they are credited and are not binding on the society as a whole.

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Department Head Change at Davis

AT press time it was learned that Clarence F. Kelly has been appointed chairman of the department of agricultural engineering, University of California at Davis, to replace Roy Bainer who will continue to serve as associate dean of engineering at Berkeley, Davis, and Los Angeles, with full responsibility for the engineering program at Davis. A full four-year engineering program is now being offered at Davis, with approximately 100 undergraduate students enrolled. It has been reported that applicants for the coming fall term have already reached 117. In addition approximately 40 graduate students are enrolled in agricultural engineering. Further details will be carried in the September issue.

Bibliography on Pump Drainage with Abstracts

A "BIBLIOGRAPHY of Pump Drainage with Abstracts," prepared by the ASAE Committee on Pump Drainage, is available from ASAE headquarters as paper No. 61-30. This Bibliography may be ordered by Technical Paper Order Form or for 50 cents a copy.

The Bibliography contains 11 pages including 59 listings. The Committee on Pump Drainage includes: C. L. Larson (chairman), K. R. Klingelhofer, G. B. Fasken, J. C. Stephens, L. W. Herndon, R. W. Irwin, Virgil Marvin, T. L. Willrich, K. V. Stewart, and R. L. Green.

No Let Down for AE Exposition

SUMMER slump in activity has *not* been in evidence reports Shea Expositions Corp., Exposition Managers of Agricultural Engineering Exposition to be held in conjunction with the ASAE Winter Meeting, December 12 to 15, at the Palmer House in Chicago. According to the report, received late in July, applications for exhibit space have been flowing in at an accelerated rate and reservations have now been made by manufacturing concerns for a total of 33 exhibit booths. Among those recently deciding to display and demonstrate in the Exposition is The Fafnir Bearing Co., who will exhibit ball bearings. Acme Chain Co. will show power transmission equipment. The Brown-Brockmeyer Co. will display electric motors, and Wisconsin Motor Corp. will have an air-cooled engine demonstration.

Exposition management men from Shea Expositions Corp. visited St. Joseph, Mich., on July 31. In a conference with ASAE headquarters staff, many plans were discussed for making the Exposition a vital supplement to the technical paper agenda of the Winter Meeting.

Reservations for exhibit booths in the Agricultural Engineering Exposition may be made by writing Shea Expositions Corp., One Gateway Center, Pittsburgh 22, Pa.

ASAE Career Film Earns More Honors

MORE honors have been accorded the ASAE career film, Agricultural Engineering — Profession with a Future! Following its success as a first place winner in the Third American Film Festival (announced in the May issue), the film had been rescheduled for the second summer at the USDA Patio Theatre in Washington, D.C. A total of 1290 persons were in attendance at 364 performances during continuous showings from 9:30 a.m. to 5:00 p.m. each week day from May 16 through June 2.

Publicity resulting from the award also was given credit for the film being selected for showing with other top films at the Chicago International Trade Fair July 25 through August 10 in the 500-seat theatre in the McCormick Place Exposition Hall. A recent USDA Motion Picture Service newsletter has announced also that the ASAE film has been entered in the Ninth Annual Columbus (Ohio) Film Festival to be held September 13 to 15.

Report to Readers . . .

CLEAR-SPAN DESIGN FOR FARM BUILDING ROOFS

USDA (ARS) agricultural engineers have developed an improved roof of clear-span design for farm buildings. The design is an application of the hyperbolic-paraboloid principle which has been applied to man-made structures only in the last decade. This principle is derived from nature, an example being the tent caterpillar's nest which derives its strength from being curved in two directions. . . . . The clear-span roof design requires fewer supporting members than do conventional roofs. Since rafters are eliminated, more headroom is available. The roof also makes it possible to build structures faster and more economically. . . . . The clear-span roof structure, though lighter than the conventional roof, derives its strength from mutually supporting arches incorporated into the structure. The arches cross at right angles, one arch curving up, the other down.

AGRICULTURAL ENGINEERS SUITED FOR FOOD ENGINEERING RESEARCH

A Michigan SU agricultural engineer told a recent ASAE meeting that food engineering is rapidly developing a new area of cooperative scientific research, in which the principal active participants are food scientists, industry scientists, and agricultural engineers. Such an approach in the field of food engineering research, utilizing the special qualifications of these three groups, is proving highly rewarding in uncovering new ways of processing food products, especially in the direction of product improvement. . . . . The Michigan SU engineer makes the particularly pertinent point that agricultural engineers are exceptionally well-fitted by background, education and interest to specialize in the field of food engineering.

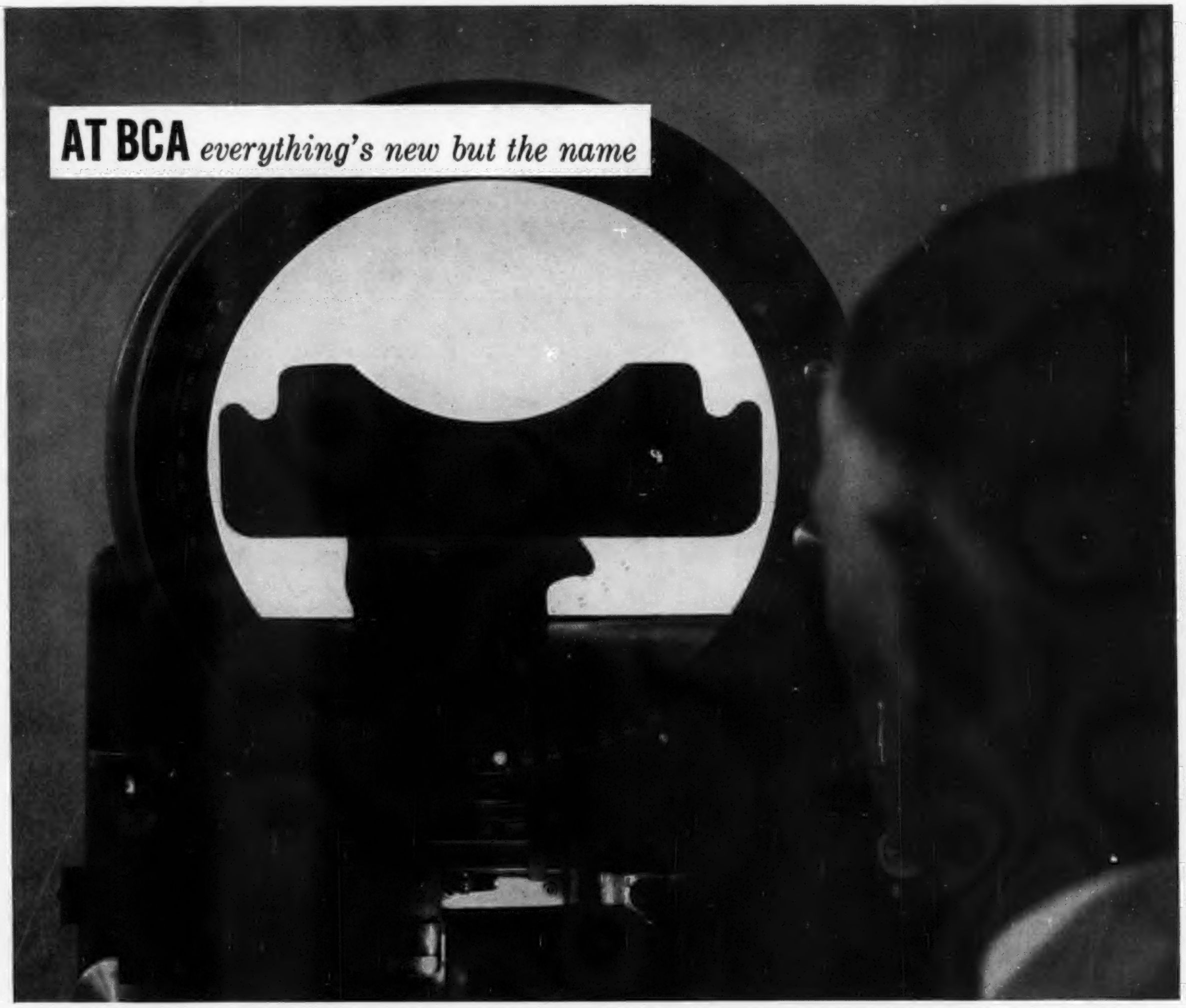
MECHANICAL GRAPE HARVESTING NOW A DEFINITE POSSIBILITY

A Cornell agricultural engineer says that the mechanical harvesting of grapes is now a definite possibility. He and his associates have designed a harvester that successfully removes more than 95 percent of the fruit and has a capacity equal to that of 25 to 40 hand pickers. These engineers also report that counts made of the condition of harvested fruit show the number of intact berries to vary from 90 to 40 percent, the lower figure representing late-season harvesting. . . . . To harvest grapes with this device, they have to be grown on special trellises, which have no effect on either the yield or maturity of the crop. In operation, as the machine moves continuously along the row, a vibrating spiked wheel rotates freely and shakes the cordon-bearing wire causing the grape berries to drop from the bunches. . . . . While this machine is still in the experimental stage, the Cornell engineers believe that development by private industry could make it available for commercial use within two to three years.

WATER PURIFIER UTILIZES ELECTRODIALYSIS METHOD

Scientists of two agencies of the U.S. Department of the Interior are studying the development of farm or village-size, water-purifying units that employ the electrodialysis method of purification. The need for such units is specially great in the Great Plains area of the USA, where expensive wells all too frequently have to be capped because the underground water is too salty for humans, animals or crops. . . . . The USDI agencies are at present developing two sizes of the water-purifying unit. The larger unit is trailer-mounted and is capable of freshening about 18,000 gallons of water daily, or enough for animal and human use on a very large ranch or in a small community. The smaller unit is limited to household use, as it has a daily capacity of only 20 gallons of fresh water. (Three other unit types are now under study.) . . . . . Where water is scarce enough and hard to obtain, farm households and small villages will likely find electrodialysis the most convenient source of water for specialized uses. However, its cost is far in excess of what would justify its use for large-scale production of irrigation water.

(Continued on page 400)



BIG PICTURE—100 TIMES ACTUAL SIZE—
checks ball bearing geometry

BCA engineers take a close, "big" look at the configuration of inner and outer rings of ball bearings with this contour projector. It magnifies profiles up to 100 times actual size—makes possible extremely accurate measurements and control of all geometric characteristics of raceway rings.

This contour projector provides essential information for BCA research in developing new and modified bearing designs. It also evaluates the production performance of precision tools and machine set-ups by checking the profiles of production raceway rings against precise design specifications. This device is only one of many BCA quality control measures that help assure uniformly high ball bearing quality.

New BCA laboratory facilities also include a variety of specially designed testing machines that simulate actual or exaggerated operating conditions. On this equipment, bearings are studied under exact operating conditions of the customer's application . . . and tested to *exceed* his specifications.

BCA ball bearings for original equipment as well as replacement use are made in a complete range of types and sizes. They serve practically every kind of industry . . . automotive, machine tool, construction and agricultural equipment, to name a few. For complete information, for experienced engineering counsel on bearing applications, contact: Bearings Company of America, Division of Federal-Mogul-Bower Bearings, Inc., Lancaster, Pa.

BEARINGS COMPANY OF AMERICA ball bearings DIVISION OF FEDERAL-MOGUL-BOWER BEARINGS, INC.

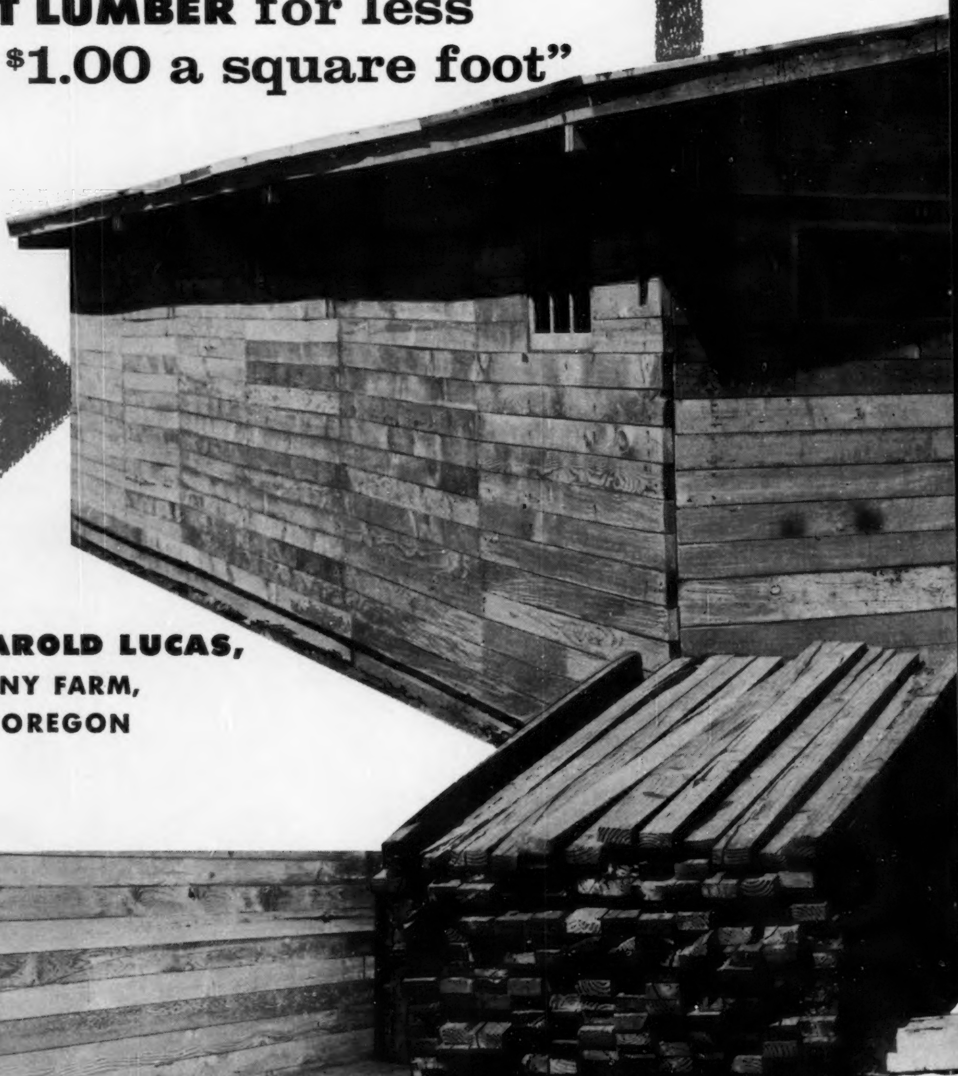
. . . Report to Readers *(Continued from page 398)*

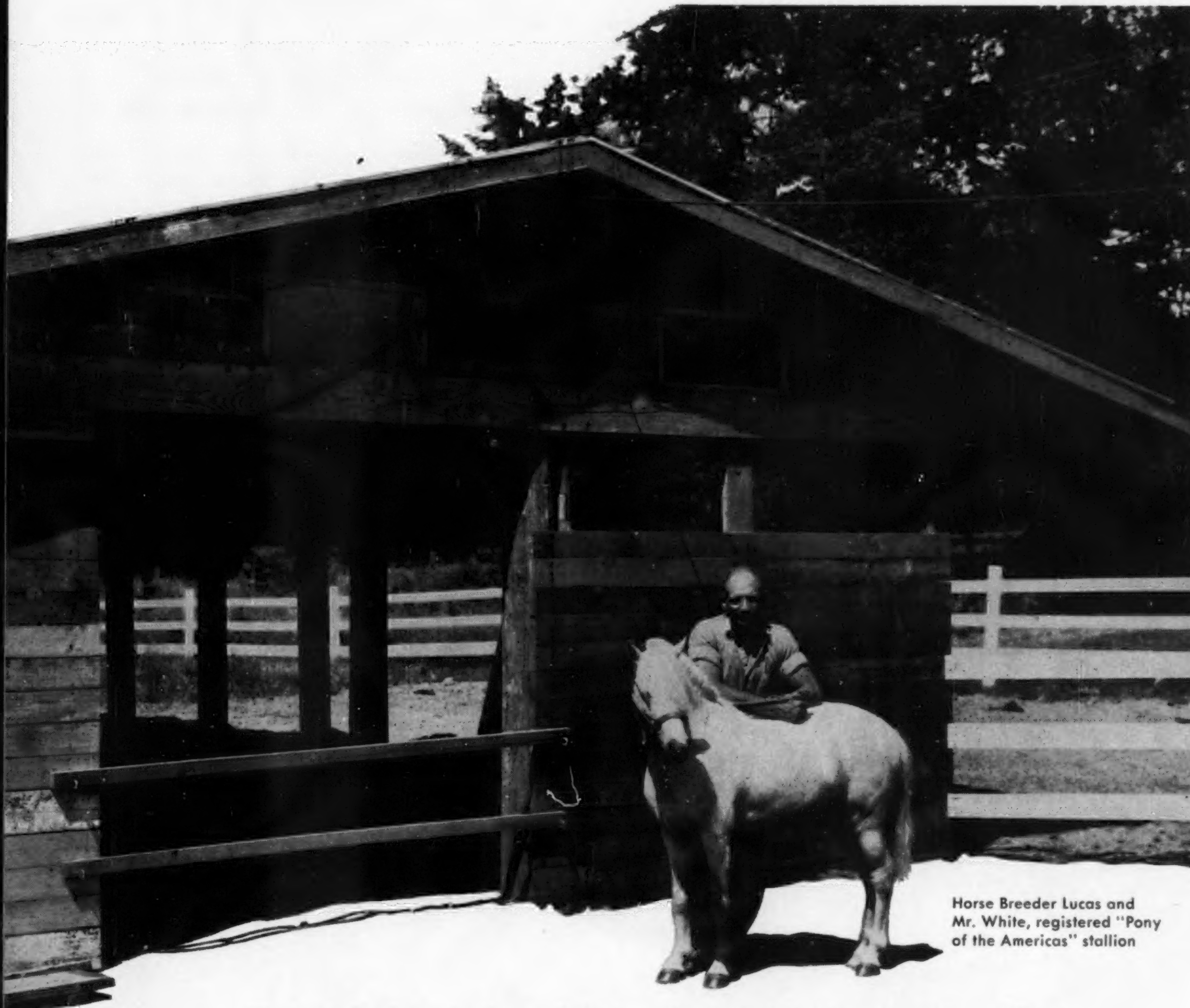
AGRICULTURAL ENGINEERS IMPROVE PARALLEL TERRACING TECHNIQUES The parallel terracing concept, developed several years ago and gaining in popularity since, has been still further improved by new design techniques developed by University of Missouri agricultural engineers. They stress the importance of so designing terrace systems that the time required to farm a field will be reduced to a minimum. This requires that terraces be as nearly parallel as possible with a minimum amount of curvature, thereby eliminating most of the point rows. . . . . To build parallel terraces, it is often desirable to vary the grade in different sections of the terrace. The method recommended by the Missouri engineers, for determining the maximum safe grade for any section of terrace, allows for the varying amounts of water that will be carried at different locations in a terrace and for the erosive force of the running water.

TENDENCY TO OVERTHIN FRUIT WITH MECHANICAL TREE SHAKER A Michigan SU-USDA horticultural-engineering research team says use of a mechanical tree shaker tends to overthin peach trees. While mechanized thinning saves labor compared with hand thinning, the trees thinned with the mechanical shaker produced an average of 36 pounds of fruit less per tree. This 13 percent reduction offset all the labor costs saved by mechanized thinning. . . . . The researchers say the tendency to overthin the fruit can be corrected rather easily. The remedy lies in doing 70 to 90 percent of the thinning with the mechanical shaker. Then, since tops of the trees are more easily thinned, they recommend hand thinning of additional peaches from the lower limbs where they can be reached from the ground. . . . . The 1960 thinning tests showed that a two-man crew averaged 28 minutes in thinning a tree by hand. With a mechanical shaker the same crew could do the work in 3.3 minutes, including a small amount of supplemental hand-thinning. Average labor cost of thinning by hand was 93 cents per tree, while mechanized thinning costs 8 cents per tree.

FARM MECHANIZATION MAKES GOOD PROGRESS IN TAIWAN Michigan SU agricultural engineers, engaged in a study (sponsored by the Ford Foundation) of farm mechanization in Taiwan, report that Free China farmers are keenly interested in modern farming methods. Progress toward mechanization has been under a handicap there, since the main crop (rice) is grown in paddies too small for the use of conventional tractors and combines. However, a lightweight tiller, easily converted to self-propulsion, was developed by an American manufacturer several years ago and became popular for tillage use in Japan. Both American and Japanese models of this machine were introduced in Taiwan in 1954 and some 2700 units are now in use there.

IRRIGATION SPRINKLER SYSTEM PROPELLED BY WATER PRESSURE In south-central Idaho water is pumped from a natural underground reservoir to irrigate what was formerly desert land. For moving the long lines of aluminum irrigation pipe from place to place, an electric water-pressure, "go-around" system was developed, several of which are in use. Each of these systems irrigates a 160-acre field from the pivot point at which it is located. From this point in the center of the field, the irrigation pipe extends out 1/4 mile and is supported by thirteen towers. Each tower, mounted on a pair of cleated wheels in tandem is equipped with a hydraulic ram to which is attached a steel arm that engages the cleats on the wheels and moves them forward at the rate of 2 feet per minute. On each stretch of pipe are 39 sprinkler heads, each throwing its spray in a half circle. At the end of each pipe is a discharge nozzle that throws the water far enough to reach the corners of the field. Total time to irrigate 160 acres is 84 hours. . . . . A 250-hp electric motor lifts water 325 feet from the well, provides pressure to operate sprinklers and moves the towers between settings.





Horse Breeder Lucas and Mr. White, registered "Pony of the Americas" stallion

"I checked costs of other materials and selected the lowest grades of West Coast Lumber because the difference in price made it possible to build a larger barn for my money. I also prefer lumber because I could design and build the barn myself.

"The barn is 32′ x 50′ which gives me space for five 10′ x 10′ box stalls, storage space for 15 tons of hay, an 8′ alley, 8′ x 8′ tac room and a 6′ overhang on the loafing area. I used low grade 2x4′s to laminate the floor of the hay storage. The barn is a pole type and 8′ lengths of 2′ x 6′ made it easy to span the openings and fasten direct to the poles.

"Another reason why I used West Coast Lumber is that wood is good for horses. Other materials are noisy during bad weather and this disturbs thoroughbred animals," Lucas concluded.

Here is another example of the practical use of the lower grades of West Coast Lumber to meet a specific building purpose economically. Ask any lumber dealer about the economies of the lower grades of lumber . . . he'll be happy to help you.

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West Coast Douglas Fir • West Coast Hemlock • Western Red Cedar
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For farm building information, write:

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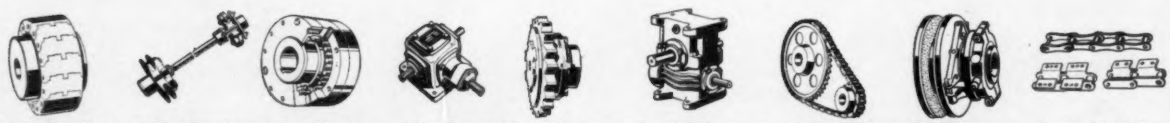
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Over Center
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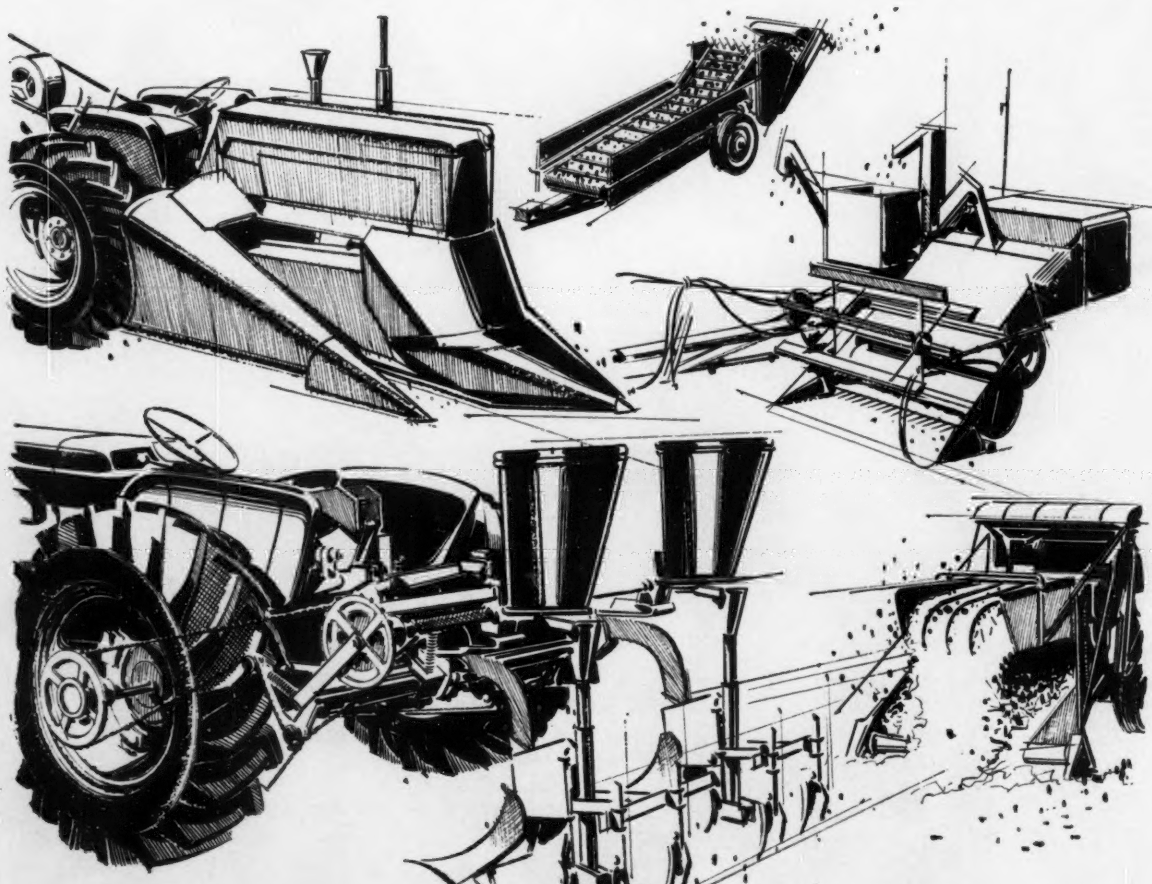

Plows of the future... designed with Space Age computers

International Harvester engineers eliminate cut-and-try plow design

Now, Electronic Brains are helping to design plow moldboards as well as moon rockets! By perfecting a mathematical system for plotting moldboard curvature, IH engineers have eliminated cut-and-try development time . . . saved years of field testing.

Electronic computer—the key. The mathematics of a moldboard would take one "slide rule engineer" better than a year to figure. But the computer, with a potential of 60,000 operations *per second*, supplies all the needed data in a couple of hours. Therefore, the computer quickly plots the best curvature for top plowing efficiency. Through this scientific approach, IH is prepared to put the most advanced moldboards in the field first!

This is just one of hundreds of projects carried on at International Harvester's Farm Equipment Research and Engineering Center, Hinsdale, Illinois. This ultra-modern center has the scientific tools and a staff of over 1,500 specialists to create the newest and finest farm equipment in the world.

INTERNATIONAL HARVESTER
World's largest manufacturer of farm equipment

THEY BUILT A STURDY WAGON FOR ONLY $125!

They couldn't find the kind of wagon they needed at the price they wanted to pay, so W. E. Church and his son, B. E., built their own! Second-hand and discarded materials were used for the 24-foot chassis. Fir wood was used for the frame and bed, and 1½" double-strength steel tubing for the chassis. The axles and wheels are from an old Ford.

The Churches operate a 455-acre dairy farm with 75 cows, near Woodburn, Ky., and raise their own feed and other crops. They prefer Texaco Products for fueling and lubricating their costly farm equipment. They like the lively power of Fire Chief gasoline for tractor and truck operation.

Fire Chief is Climate-Controlled for altitude and seasonal temperatures, which in turn gives you faster starts and smoother warm-ups. Since your engine runs more efficiently, you save money on gasoline.

Successful farmers everywhere know that *it pays to farm with Texaco Products.*

SHOWN IN PHOTO *(left to right) are Roy Phillips, manager of the Texaco Consigneeship at Bowling Green, Ky., W. E. and B. E. Church.*

ANOTHER TEXACO BOOSTER!

Mrs. Louise Ingham farms 850 acres near Booneville, Iowa, and raises hogs, sheep and calves. Mrs. Ingham is a booster for Texaco Products, especially Advanced Custom-Made Havoline Motor Oil. Havoline's exclusive combination of detergent additives prevents harmful engine deposits and wear. Engines deliver full draw-bar power, and more fuel mileage.

Here a delivery is being made by Texaco Distributor Ferd Jungman, Van Meter, Iowa.

BUY THE BEST..BUY TEXACO

TUNE IN TO THE HUNTLEY-BRINKLEY REPORT, MONDAY THROUGH FRIDAY, NBC-TV

Agricultural Engineering

August 1961
Number 8
Volume 42

James Basselman, Editor

FRANK J. WELCH
Assistant Secretary of Agriculture

New Frontiers of American Agriculture

An address prepared by Orville L. Freeman, Secretary of Agriculture, for presentation at the 54th Annual ASAE Meeting, June 1961, Ames, Iowa. Presentation was made by Frank J. Welch, Assistant Secretary of Agriculture, in behalf of the Secretary who was unable to attend.

ONE of the most significant characteristics of our age is the fact that physical, scientific and technological progress is far outrunning social, political and economic change. No recent event illustrates this fact more dramatically than the manned space flights by our nation and Russia.

But man does not yet know how to use this new power, and governments of men do not know how to control it for the benefit of mankind. They have developed no social instruments to control the scientific instruments that now boast such incredible precision that they can pinpoint targets on the other side of the earth. This social lag represents a dangerous gap, one that must be closed if men on earth are to have any hope for security against the destructive potential of the power they have created.

But what has this to do with agriculture? Your president, Professor L. W. Hurlbut, noted the relationship in his address. He spoke of another example of the incredible progress which science and technology have brought. He pointed out that the age of scarcity has passed and we are entering in this nation an age of abundance where sufficient food and fiber can be made available for every man, woman, and child.

In recognizing this achievement of American agriculture, he also pinpointed another area where a dangerous gap exists. Technical and scientific progress has far outrun social and economic change in agriculture as well as in the conquest of space. And I truly believe that the social lag represented by the gap between the abundance of food that we *can* produce and the extent of hunger that exists in spite of this potential for abundance may, in the long run, be far more significant than the gap in space.

I am sure the Communist nations with their food shortages realize far better today that to people who are really hungry, bread and milk at hand are more important than a star in the sky. To millions of men and women throughout this world the higher standards of living that can be achieved if we properly use our capacity to produce are of more direct and personal concern than the discovery of other worlds.

It is the special responsibility of those of us concerned with agriculture to close the gap represented by our capacity to produce abundantly on the one hand and, on the other, our lack of the social and economic organization necessary to both manage and utilize that abundance.

For these reasons, I consider it a special privilege — a special opportunity — to meet with the American Society of Agricultural Engineers here at Ames. Our nation owes a great debt to your profession for bringing science and art in the use of material, energy and men to our agriculture.

Thanks in large part to your effort most of our farms are mechanized. More and more farmers are using mass production techniques to produce commodities of uniform quality in high volume and at low cost. And these techniques are being continually refined.

Land is continually being reshaped and water rechanneled to expand agricultural productivity and conserve these useful and essential resources.

Agricultural engineering has not stopped at the farm gate, but has gone on to improve rural industries and services — the lockers, canneries, creameries and slaughter houses — that upgrade agricultural commodities and build markets.

But with this proliferation of scientific and technical advances there has not come the necessary social and economic advances which will keep the farmer from being swamped when he applies the fruits of agricultural engineering to the farm. It is here that the social lag becomes dangerous.

With your help, the farmer in the past 20 years has tripled his output per hour of work. In 1941, the average

(Continued on page 433)

Field Production of Hay Wafers

New development combines use of flail-type rotary pickup and wafering unit

V. J. Lundell and D. O. Hull
Affiliate ASAE *Member ASAE*

THE wide interest in mechanical feeding systems is evidence that farmers will more and more insist on complete mechanization of their hay harvesting, storing and feeding facilities. In Iowa about 15 percent of all the hay harvested is chopped; the other 85 percent is baled. If mechanical systems are not developed for feeding hay which is either chopped or baled, farmers will tend to reject both of these harvesting methods and quite possibly resort to alternate forage storage systems. One of the alternative methods offering the greatest possibilities to the most farmers is field wafering of forage crops. Wafers appear to provide a form of hay which can be mechanized from field swath to feed bunk.

Evaluation of the Field Wafering System

Before research was begun to develop the field wafering machine referred to in this paper, extensive opinion surveys were made as to the practicability of field-produced wafers. Agricultural engineers, agronomists, animal husbandmen, livestock nutritionists and farmers, who were familiar with pelleted feeds, were asked for their opinions as to the practicability of field wafers for livestock feed. Several of the state experiment stations had preliminary studies under way to evaluate hay wafers. The favorable reaction as a result of the wafering survey prompted the research and experimental program to develop a field wafering machine.

Considerable information has been reported by research engineers on the problems involved in making field wafers (1, 2, 3, 4)*. Much was already known about the types of forage materials which could be formed into a wafer and of some of the physical characteristics of the product that would be produced. Earliest of these studies was by Beresford (5) at Idaho in 1932 who first demonstrated that wafers could be made from long hay stems. It was Dobie (6) of California who gave the correct analysis of another basic problem, when he observed that stationary wafering machines operate best with uniform hay moisture conditions and that field wafering might necessitate improved mowing and windrowing techniques to overcome this variation.

Preliminary investigations of several potential hay-compression devices indicated that certain basic problems would need to be resolved to develop the design for a successful wafering mechanism. These included the following:

(a) Devising a method of dissipating the heat of friction generated when the forage materials are subjected to repeated and rapid high compressive actions

(b) Developing a method to permit a uniform and uninterrupted flow of the forage materials from the windrow to the wafering mechanism

(c) Solution of a myriad of wear problems in the compressive elements resulting from handling the relatively abrasive dry forage materials

(d) Providing sufficient die capacity to make a commercially acceptable unit.

Preprocessing Simplifies Wafering

Making a field wafer is about like making a mud ball. If proper moisture control is not maintained, the mud ball either slumps or falls apart, depending upon whether too much or too little water is used. The consistency of the hay before wafering, as with the mud ball, is important. It is for this reason that the "open die" type of wafering machine represents only a functional part of a hay wafering system. The hay is cut, conditioned by laceration and placed in a small windrow for curing in a single operation, by use of a flail-type forage harvester. The wafering machine further reduces the conditioned material, by use of a rotary flail-type pickup with a concave bar before the hay is fed to the wafering mechanism. Because of the importance of maintaining quality and uniform consistency in the material to be wafered, the conditioned forage might be described as "homogenized" hay. Homogenization is generally defined as "a technique or action to produce more uniform texture throughout by breaking down and blending the particles."

There are several basic reasons for the success of the open-die type of field hay-wafering system; these factors are directly related to proper preparation of the material before it enters the machine:

1 The hay materials are preprocessed in the field to produce a lacerated or shredded hay which has uniform texture with a good blending of broken stems and leaves. This condition favors good interlocking of plant fibers to help hold good form in the wafers. (This doesn't mean that preprocessing is an absolute necessity; short, fine legume hay has been successfully wafered without treatment.)

2 A uniform windrow is laid down which has reduced mass and good flow characteristics when it is fed into the wafering mechanism.

3 The conditioning process permits relatively good control over moisture content with much more rapid field curing than with long, loose hay.

4 The reduction process can be performed with green plant material where cutting and breaking is relatively easy.

Paper presented at the Winter Meeting of the American Society of Agricutural Engineers at Memphis, Tenn., December 1960, on a program arranged by the Power and Machinery Division.

The authors — V. J. LUNDELL and D. O. HULL — are, respectively, president, Lundell Mfg. Co., Inc., Cherokee, Iowa, and extension professor of agricultural engineering, Iowa State University, Ames.

*Numbers in parentheses refer to the appended references.

This process is most important with first and second cuttings when the forage growth may be tall and rank.

5 The conditioned hay material lying in the windrow on the stubble forms its own thatched roof to shed rain and dew. The windrow limits direct sun exposure and helps hold good color in the wafers (7). Wafers of good quality and color have been made from hay in windrows which have shed as much as 4 to 5 in. of rain in two to three days.

6 Reduction of the hay material and uniform windrows make possible a smaller, lighter field machine with a lower total power requirement.

Crop Preparation

It is important that the operator of the hay-conditioning machine fully understand the process before attempting to prepare hay for wafering. This involves operating the flail-type forage harvester at a relatively high ground speed, say, 5 to 7 mph. The speed of the cylinder is reduced to the extent that the hay will just be carried up over the blower spout and will feed uniformly and freely down onto the conditioning foot to form a fluffy windrow. It is usually necessary to remove the shear bar so that the material will not be reduced too much in length. It is recommended that the windrow of homogenized hay be turned gently with a wheel turner a few hours before wafering to give faster drying and to provide more uniform moisture throughout (7).

Field studies of the flail-type hay conditioner indicate that leaf loss is no more serious than with the roller and crimper machines. The fresh-cut green leaves are picked up and concentrated with the lacerated hay stems in the windrow for curing. The rotary flail pickup permits good recovery of the preprocessed swath.

Design of the Wafering Machine

Two machines are utilized for the complete wafering process. The preprocessed hay is taken from the windrow by the flail-type rotary pickup. The dry hay is somewhat further reduced by the knives and concave in the pickup. It is carried by impact in a moving air column to the feed chamber of the wafering mechanism. The hay enters the wafering mechanism from the top.

The wafering unit has but one moving part. But there are two functional elements which work together as a unit mounted on a single drive shaft between heavy-duty precision bearings. These functional elements are a twin-flight feed auger (Fig. 1) and two pressure rollers mounted on arms extending outward from the drive shaft (Fig. 2). The feed auger sets directly ahead of the pressure rollers and conveys the preprocessed hay to the rollers for compression. The feed auger is equipped with deflector vanes (Fig. 2) which direct the hay outwardly against a multiple-throat, open-type die and directly ahead of the pressure rollers. The wafering die is held stationary. The pressure rollers rotate inside the die forcing the compressed forage material radially against and through the die. Since the entire unit is mounted horizontally, the die is in the vertical position. Centrifugal force and the fanning effect of the twin-flight auger forces the material uniformly and radially against the housing of the feed chamber as it moves toward the pressure rollers. The design of the deflector vanes makes it possible to have hay directed uniformly and continually to the initial compression chamber between the pressure rollers and the die throats. At no time is there any compression of the hay material by the twin-flight feed auger.

The field wafering machine utilizes what might be called a stationary, automatically controlled open-die system with rotating auger and pressure rollers. The pressure roller does not press directly against the face of the die but rather depends on a build-up of compressed hay materials to provide the cutoff action so that the compressed materials can be forced into the throat of the wafer-forming chamber. There are narrow hardened cutoff edges at the die throats instead of a pressure plate as with the stationary pelleting machines. Stationary pelleting machines use rotating dies with stationary rollers. This is the basic difference between the two machines. The field wafering machine will handle the longer preprocessed hay while the stationary pelleters require finely ground materials.

As the materials are pressed through the die throats, they pass into the wafer-forming chambers. The die has 48

Fig. 1 Top view of the wafer-die feed chamber, showing the twin-flight auger which feeds the preconditioned hay to the wafering die; also the nozzles for adding moisturizing agents in the feed chamber. (The air-pressure relief duct exhausts air produced by the fanning effect of the flail-type pickup)

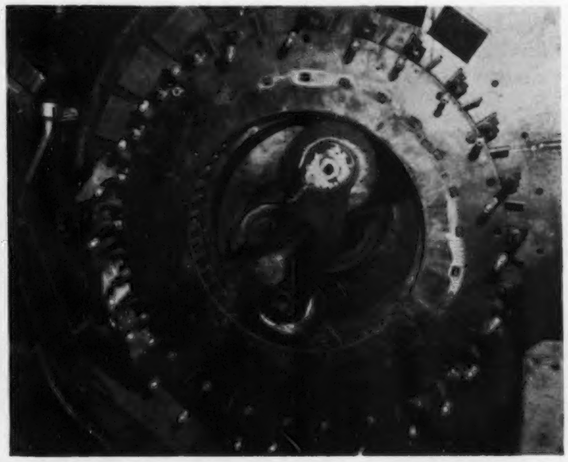

Fig. 2 End view of the open-type wafering die with working parts. (The steel plate separating the wafering chamber from the extrusion chamber has been removed)

square or rectangular wafering chambers, depending upon wafer size, located around the periphery of the pressure rollers. The adjustment of pressure on the sides of the wafering chambers is controlled by a hydraulic system. In production models, hydraulic pressure on the die will be maintained automatically. Pressure requirements vary from 100 to 1,000 psi. Pressure on the die can be regulated from the tractor operator's seat. As the hay material is extruded from the back side of the wafering chamber, it strikes against a deflector plate. This plate pushes the extruded column outward slightly and causes the individual wafers to break off the extruded section. The position of the deflector plate is adjustable so that the length of the wafers can be controlled. The deflected wafers are conveyed directly to a trailing wagon with a small flight elevator. This machine can be equipped with dies to produce either a 2 x 2-in. or a 1 x 2-in. wafer. The total open area of the die is 158 sq in. at the throats of the wafering chambers. The wafering chambers are of sufficient length so that the compressed hay is held under pressure for approximately 5 sec before being released. The bulk density of alfalfa hay wafers produced by this machine will run about 25 lb per cubic foot. The capacity of the machine, with a 125-hp engine, is 5 to 6 tons of wafers per hour. The completed wafers require about one-third to one-fourth the storage space occupied by the same weight of baled hay.

The density of the wafers is controlled by the hydraulic system. The die is automatically regulated through the manifolding of the hydraulic system (Fig. 3). This permits uniform pressure to be applied on all wafers in the wafering chambers at the instant the pressure is applied. If there is any damp hay in the windrow, or if a chunk of wet material is encountered and this material is directed onto any section of the circular die, the pressure applied to the hydraulic cylinders pressing on the sides of the wafering chambers causes them to close down against the softer, wet material. This action automatically maintains uniform density for all of the wafers simultaneously. In the first experimental designs, before the controllable die was developed, a tapered, rectangular-shaped wafering chamber was used. This fixed die did not tend to adjust itself to differences in moisture content and variations in the consistency of the material, which resulted in a lack of uniformity in the formed wafers.

Moisture Control

To form field wafers successfully, it is advisable that careful control be maintained over the moisture content of

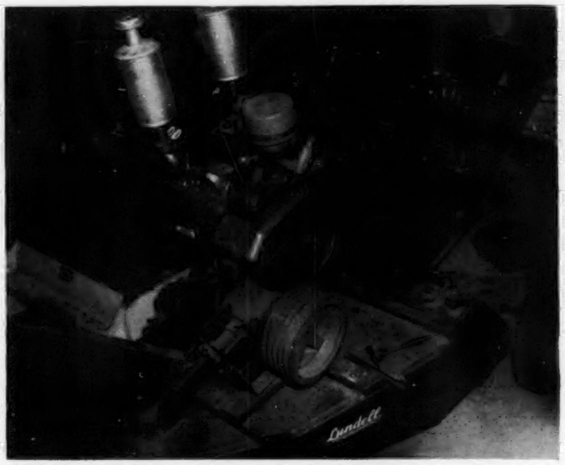

Fig. 3 This view shows how the manifolding from the hydraulic system is attached to the pressure-regulating cylinders which press against the sides of the adjustable wafering chambers. (The plate separating the wafering chamber from the ejection chamber is shown in place)

the hay being fed to the wafering chambers. The hay should be cured in the windrow to the moisture level at which it can be safely stored. Conditioning permits the moisture content to be reduced at a relatively rapid rate in good drying weather. Experience points to optimum moisture contents in the range of 14 to 18 percent. It is advisable not to exceed a moisture content of 18 percent in the finished wafers.

Constructed in the frame of the wafering machine is a tank which holds approximately 150 gal of the moisturizing agent. The pump which maintains pressure on the spray nozzles bypasses back to the tank to help maintain the solution or suspensions. The moisturizing agent is sprayed directly into the twin-flight auger feed chamber (Fig. 1). The twin-flight auger turns or fans hay entering the feeder housing so that the spray nozzles can effectively wet the surface of the hay. This is important. Production models of the wafering machine will permit application of the moisturizing agent at 10, 20, 30 or 40 gal per hour. Automatic controls will prevent moisture being sprayed onto the die before the wafer-forming chambers are filled during warmup.

Experience has shown that if the plant material is too wet, the operator will tend to try using the moisture in the hay as a binding agent. These wafers will not hold together. It has not been determined at what maximum moisture

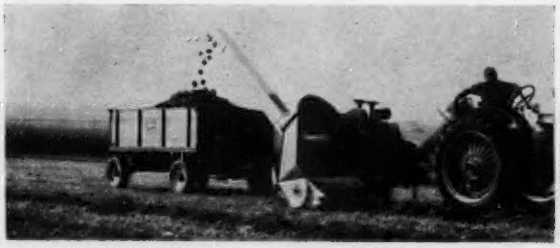

Fig. 4 Quartering view of the field-wafering machine showing flail-type pickup, operator's control pedestal, and general implement-wagon relations in the field

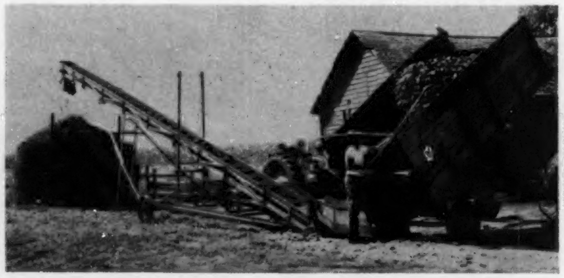

Fig. 5 Elevating wafers from wagon into corncrib picket storage bin

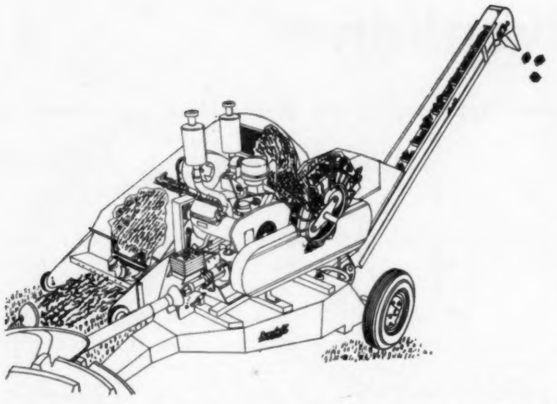

Fig. 6 Sectional sketch showing operating elements of the field hay-wafering machine

content structural collapse of the ejected wafers is first encountered in various forages. This point obviously varies over quite a wide range. Dobie (3) feels that 30 percent moisture is probably a maximum. This means that the wafers would need to be dried to a point of safe storage unless stored in a gastight silo. Dobie (6) also has observed, and correctly so, that it is most important that the moisturizing agent be applied only to the surface of the dry plant material. When this action is completed, it tends to produce the extra bonding effect needed to hold the very dry material together.

Moisturizing Agents

Plain water and a molasses mixture in water have both been used as moisturizing agents with legume hays. Since molasses solutions contain relatively less water, is is possible to make a wafer with a lower moisture content which might not need to be dried before storage. Preliminary trials have been made which indicate that there is a possibility that cornstalks and other rough forages can be successfully wafered providing proper moisturizing agents are used. These moisturizing agents might include materials such as urea to improve digestibility. Obviously this area requires further investigation and study by nutritionists and engineers.

Power Requirements

The wafering machine is designed to be driven by either a 125-hp auxiliary power unit or a combination of PTO and a 56-hp engine. The PTO shaft is equipped with an over-running clutch. The power unit can be started by the tractor engine through the PTO shaft. The wafering machine can be operated as a stationary unit by replacing the spout leading to the wafering mechanism with a hopper.

Operating the Wafering Machine

To produce field wafers successfully, the die must be warmed up. About two to three minutes of operation will warm the die sufficiently. As previously indicated, the pressure on the sides of the wafer-forming chambers is controlled by the hydraulic system. This pressure is released when the machine is stopped. It is not necessary to clean or remove material from the die when the machine is allowed to sit overnight. For seasonal storage, the die should be cleaned to prevent rusting and corrosion.

As the wafering machine begins to pick up the material from the windrow, hydraulic pressure is applied to the die. A relatively large amount of moisturizing agent is applied to the hay during the time that the die is warming up. The first wafers which are well formed will be relatively wet or moist in appearance. As more hay is fed to the warming wafering chambers, the moisture applied at the auger feed chamber is reduced until satisfactory wafers are being formed with a minimum amount of moisturizing agent. It has been observed that it is not difficult to regulate the moisture to form good wafers. If the material is too dry, the wafers tend to fall apart. If too much moisture is being applied, it becomes visible on the surface of the freshly formed wafer. This condition can be observed from the tractor seat by the operator and immediately be corrected.

It has been found that it is possible to get wafers too hard from a feeding standpoint. A small amount of fines coming through the machine indicates that the wafers are not too hard. When no fines are seen falling into the wagon, it is usually an indication the wafers are too dense for good feeding results. Fines have never been a problem when wafering legume hay; they are more of a problem with grasses, but usually they will not exceed 1 to 2 percent of the wafered hay.

Experience with the storing of wafers indicates that it may be necessary to artificially dry some field-made wafers for safe storage. Field wafers have been produced and stored in pickets. It is believed that the lowest moisture content possible consistent with well-formed wafers is desirable. Adding moisture beyond the point needed to produce well-formed wafers only adds to storage problems.

Wafers coming from the die are relatively warm. A fan draws waste heat from the air-cooled engine and pipes it into the extrusion chamber. This helps remove moisture on the surface of the wafers. The heat of compression will possibly contribute somewhat to drying. It is believed that it will be possible to attain a surface moisture reduction of 1 percent, or possibly 2 percent, in the wafer by the utilization of waste engine heat. There is also a possibility that a supplemental heat drier of simple design could be incorporated in the wafering machine.

Tramp Materials

During the development of the field wafering machine, no particular problems with foreign objects or tramp materials entering the wafering chambers have been encountered. Using the flail forage harvester in the preliminary process permits the operator to watch and listen for objects which might be carried over into the windrow, and a second warning may be given when the flail pickup on the waferer moves the material to the wafering unit. In development studies, the wafering mechanism was intentionally slugged with various types of foreign objects. Serious damage has never been experienced with intentional slugging of the machine. If the slugged machine is turned backward by hand and the hopper opened, the obstruction can usually be removed without difficulty. However, this is not to infer that it is impossible to damage the machine with foreign objects or by intentional sabotage.

Summary

The wafering machine discussed in this paper is relatively simple in design and construction, but there are cer-

(Continued on page 423)

Upstream Flood Prevention

Over-all approach in the Upper Hocking watershed

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DURING the past 25 years, methods for reducing the flood damages occurring along the rivers and streams of the nation have gone through some evolutionary changes. Prior to 1936, most of the attention was directed to flood *control* measures on our major rivers. By the middle 'thirties, many of the nation's leaders had become increasingly aware of the tie between serious floods downstream and excessive erosion on the watershed lands above. The Flood Control Act of 1936 (Public Law 738, 74th Congress) recognized this tie by authorizing agencies of the U. S. Department of Agriculture to study the watersheds above existing and future flood control projects for the purpose of determining watershed-treatment methods to reduce erosion and provide runoff and waterflow retardation.

These studies showed that a major reduction in soil losses could be effected by means of installing various land-treatment practices on the lands within the watershed. They also showed a wide range of effectiveness in reducing peak floodflows. The reductions were progressively less as the drainage area became larger. In the smaller drainage areas, the intensity of storm rainfall quite often exceeded the infiltration rates of the soil even under the best management practices. It also became apparent that, in most upstream watershed areas, structural measures would be needed if a truly effective watershed-protection and flood-prevention program was to be realized.

As the pressures and demands for maximum production for the war effort began to slacken, another milestone was passed when the Congress passed the Flood Control Act of 1944. This act authorized the U. S. Department of Agriculture to plan and carry out a complete watershed-protection and flood-prevention program on 11 watersheds throughout the nation. Much valuable work was done and many useful procedures were developed in these 11 projects.

Although this program was well received by local watershed residents and the over-all watershed approach proved to be very effective, experience showed that these projects were quite generally considered federal projects since they were federally initiated, federally planned, and installed with federal money. This sometimes led to easement difficulties as well as problems of adequate maintenance by local people. These projects pointed up the need for more local initiative and more local participation. They also showed that the most effective watershed units were those in which the residents had a common interest and mutual concern.

In 1953 the Congress earmarked part of the regular annual appropriation to the Soil Conservation Service to be used in some 62 "pilot" watersheds in 33 states to demonstrate the soundness of watershed protection and flood prevention in smaller unit areas and also to demonstrate the effectiveness of a partnership-type arrangement between federal, state, and local groups to share in the planning and the costs of the recommended work. The Upper Hocking watershed at Lancaster, Ohio, was one of the 62 "pilot" watersheds.

This paper describes the soil and water management problems in the Upper Hocking pilot watershed and the remedial program put into effect to alleviate these problems. The work applied in this watershed demonstrates the opportunities for developing remedial programs in thousands of other upstream watersheds throughout the country.

DESCRIPTION OF WATERSHED

The Upper Hocking watershed is located some 30 miles southeast of Columbus, Ohio, and covers the headwaters of the Hocking River, west and north of Lancaster, in Fairfield county. It includes an area of 31,418 acres (49 square miles), which is about four percent of the total drainage area of the Hocking River at the confluence with the Ohio River. The topography of most of the watershed is gently rolling as a result of glacial action. Terminal moraines characterize the eastern, southern, and southwestern boundaries. Elevations range from 1,240 ft above sea level along the outer rim of the watershed to slightly above 800 ft in the flood plain at Lancaster.

There are 287 farms in the 27,770 acres of farm land in the watershed. The average size of full-time farming units is approximately 150 acres. The soils are productive and support a well-developed system of general grain-livestock farming. Slightly over ten percent of the watershed area, or 3,202 acres, is in the flood plain. The bottomland outside the city is intensively cultivated, having about two-thirds in grain each year. Within the city, the flood plain contains some 44 wholesale, retail, and small manufacturing concerns along with 90 to 100 city blocks of residences.

Floods have been frequent along the Upper Hocking and Hunters Run which joins the main channel in Lancaster. The most serious flood occurred on the night of July 21-22, 1948. An intense thunderstorm, with its center about three to four miles south of the Hunters Run tributary*, produced an average of 6.9 in. of rainfall over the 11.7 sq mi Hunters Run tributary in a period of 2½ hr. The runoff from the deluge averaged 5.1 in., causing an estimated loss in excess of $1 million to crops, livestock, fences, roads, bridges, and real estate.

Paper presented at the Winter Meeting of the American Society of Agricultural Engineers at Memphis, Tenn., December 1960, on a program arranged by the Soil and Water Division.

The author — C. Edwin Smith — is watershed planning specialist, Soil Conservation Service, USDA, Upper Darby, Pa.

Acknowledgments: The assistance and comments of all those participating in preparation of this material are gratefully acknowledged. Among them are H. M. Kautz, V. McKeever, J. W. Karban, J. Tinivell, B. A. Roth, W. W. Steiner, R. S. Brown, P. L. Fogle, H. H. Richardson, J. B. Garrett, Miss Marian V. Logan, and others. The assistance of G. E. Oman and members of his staff is gratefully acknowledged in the preparation of the charts. The help of the cartographic units of the Soil Conservation Service at both Beltsville, Md., and Milwaukee, Wis., also is appreciated.

*Cross, William P., Local floods in Ohio during 1948. Bulletin 18, Ohio Water Resources Board, July 1949.

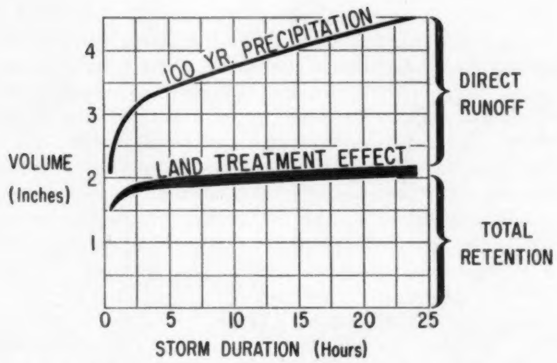

Fig. 1 Volume vs. duration of rainfall and infiltration (Upper Hocking watershed, Ohio)

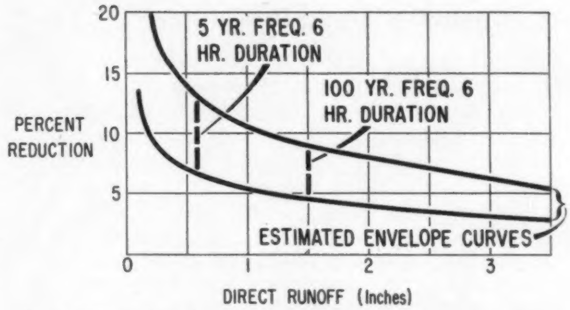

Fig. 2 Effect of land treatment on direct runoff (Upper Hocking watershed, Ohio)

A REMEDIAL PROGRAM

As in most watersheds, flood damages in the Upper Hocking are caused by both overland flooding and the deposition of sediment transported by the floodwaters. Damages to both agricultural and urban property are involved. About 40 percent of the total damages is directly associated with the sediment in the waters. Further analyses showed over three-fourths of the gross erosion occurred in the form of sheet erosion on the cropland in the watershed. This fact immediately suggested one form of protection, i.e., improved conservation treatment of the lands in the watershed.

Land Treatment

The land treatment work in the form of conservation rotations, strip cropping, contour farming, terracing, pasture improvement, and other lesser measures, is the first line of defense against erosion losses.

Although these measures have their greatest effect in controlling erosion, they also affect surface runoff from storms. Improved vegetal cover reduces the sealing of the surface soil by shielding it against the direct impact of raindrops. This, together with better soil aggregation from improved agronomic practices, improves the infiltration rate. The effect can best be illustrated by examining Fig. 1, showing a mass rainfall-infiltration curve for various storm durations. The upper line on this chart represents expected amounts of total rainfall for the respective storm durations. The lower line shows the total amount of precipitation retained. The increase in retention approaches a constant for durations in excess of three to four hours. The curve for improved conditions shows this same general trend.

Two general effects of land treatment on direct runoff volume are illustrated. First, for a given rainfall intensity, such measures have their greatest influence upon the shorter duration storms which, incidentally, occur more frequently on the smaller watersheds. This results from improving the intake rate of the surface soils and is effective until the rainfall rate exceeds the inherent permeability rate of the soil. It also is recognized, however, that the intensity of the rainfall is a major factor influencing the percentage of precipitation that can be retained by the soil. The second effect can be seen from the divergence of the rainfall and retention curves. As the duration of storms increases, the amount of reduction in runoff by land-treatment measures represents less and less of the original total direct runoff.

The relative magnitude of this latter effect can be better understood by examining a set of envelop curves† showing the percent reduction in direct runoff from changes in land treatment on watersheds in the corn belt area similar to the Upper Hocking. For example, Fig. 2 shows that a frequent flood, as illustrated by a five-year frequency flood, may be reduced an average of about ten percent by improved land treatment; whereas, such land-treatment changes produce less reduction on larger floods.

Fig. 2 also illustrates another point which is often overlooked, i.e., the effect the land-treatment has on reducing the average annual damages that occur in agricultural areas. The studies in the Upper Hocking watershed, as well as in other watersheds throughout the country, show that in the upstream watersheds about 90 percent of the flood damages to agriculture result from the frequent floods occurring more often than about once every five years. Even though it is clearly recognized that land treatment work may have little effect upon peak storm runoff from the larger storms, such work does have a significant effect upon the less intense but more frequent storms which cause the bulk of the average annual damages.

It should be pointed out that the effects exemplified by these charts are only estimates used for the discussion since the current procedures were not available at the time the data for this pilot watershed were developed. However, through a network of rainfall and runoff instrumentation, along with suspended-load measurements and a record of land use and treatment, it is hoped that the evaluation programs planned in this pilot watershed will provide a more complete understanding of the effects of land use and treatment.

Stabilizing Structures

Recognizing the limitations of the land use and treatment described above, consideration was given to the second line of defense against floods, i.e., the stabilization of eroding waterways which drain several farms.

This stabilization accomplishes three main objectives. First, the use of small, compacted-earth, retarding-type dams having the crest of the principal spillway set at the elevation of an active gully head upstream from the structure, generally will eliminate further gully erosion. Second, it makes possible improvement of the waterway above the present gully head to serve as a terrace outlet or to permit

†Based upon a curve developed in April 1957, by Frank P. Erichsen, Soil Conservation Service hydrologist, Milwaukee, for one runoff curve number change, using procedures shown in the SCS hydrology guide.

the installation of strip cropping, which otherwise could not be done because of the unstable waterway. Third, by reducing the rate of flow in the steep-graded channel immediately downstream from the structure, bank erosion is reduced.

In the Upper Hocking watershed, 22 of these stabilizing-type retarding dams, ranging from 11 to 31 ft in height, control waterways draining a total of 2,415 acres. These structures contain a total of 172,733 cu yd of fill and contracts for their construction totaled $144,050.

Floodwater-Retarding Structures

Even though the stabilizing structures mentioned above include retarding features in their design, they control the runoff from too few acres to reduce flood stages sufficiently at the principal centers of damage. Thus it was found necessary to supplement the above measures with floodwater-retarding dams, the third and foremost line of defense against floods.

In selecting structure sites which will provide the greatest amount of control of floodflows, first consideration was given to the location and kinds of property being damaged. Fig. 3 shows the principal tributaries and the major flood damage centers in this watershed.

In this case the urban damages are concentrated at the lower end of the project area, while the agricultural damages are concentrated on the tributaries and the main valley above town.

Six of the structures were located immediately above areas of agricultural damage, while two sites were selected within areas having agricultural damage. The upper six structures, which control 10,589 acres of drainage area, were designed to protect the agricultural areas from frequent floods, as well as to provide protection to the city for the larger floods. However, due to the timing of flow from each tributary and the large amount of uncontrolled area below the upper six structures, the lower two sites were needed to provide additional protection for the major floods affecting the city by controlling the flow from 5,025 additional acres.

To prevent unwarranted use of these lower two structures, they were designed with a straight-through, culvert-type outlet to permit the runoff from lesser storms to pass through without detention. The culvert sizes were limited so that floodflows greater than the 25-year frequency runoff would be temporarily retarded. Thus this system of structures will reduce the flood stages within the city about three feet for the project design flood (6 in. in 6 hr) while the stage reduction in Lancaster for flows more frequent than once in 25 years will be less than a foot.

In contrast, the six upper structures were built using the drop inlet-pipe conduit type of principal spillway. The rate of outflow was based on keeping the frequent (two to five-year frequency) floodflows within the channel banks throughout the agricultural reaches below the structures. To accomplish this objective, each of the six structures was designed with a principal spillway having a two-stage inlet.

Two different types of two-stage inlet spillways were used. Structures No. 1 and No. 2 both have a low-stage and a high-stage inlet. The outflow through the low-stage inlet is regulated by a 24-in. reinforced concrete culvert pipe. It therefore controls the frequent floodflows as well as those up to the design flood runoff of 6 in. in about 6 hr.

Floods greater than the design flood will cause flow through both the low and the high-stage inlet. A sod emergency spillway is provided for floods producing more than 9 in. of runoff in 6 hr.

The principal advantage of this type of two-inlet spillway is the relatively constant outflow which is characteristic of pipe-flow conditions for a wide range of static head. Such a spillway is advantageous also when a rather long tube section is required, coupled with a large range in temporary flood stage. By reducing the length of the monolithic concrete barrel section needed, some saving in concrete is possible over the single inlet having ports set below the top of the inlet to serve the same purpose as the low-stage inlet. One apparent disadvantage to the two-inlet spillway used on the first two structures in the project is the difficulty in preventing trash from collecting in them.

To overcome this problem, the last four structures were designed with a single inlet with ports to provide the flow control needed for the lesser storms. To reduce the amount of trash passing through, over, or retained on the trash guard, a "flat top" was used as shown in Fig. 4. Since most trash has a tendency to float near the surface, the spillway entrance will be kept relatively free of trash at high stages. At lower stages the sloping face of the trash guard will have a tendency to be self-cleaning as the water recedes.

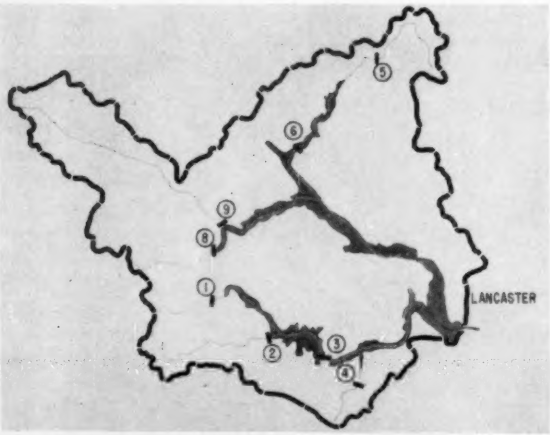

Fig. 3 Damage centers in relation to dam sites (Upper Hocking watershed, Ohio)

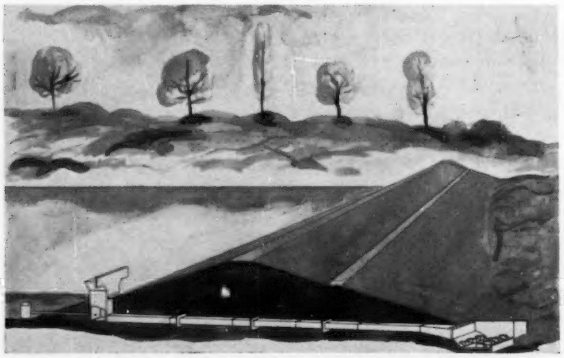

Fig. 4 "Flat top" type of inlet structure designed to reduce amount of trash passing through, over, or retained on the trash guard

This feature not only will reduce the maintenance work, but also will provide added safety at times when a second or third flood occurs before maintenance work can be accomplished.

The eight floodwater-retarding structures, ranging in height from 25 ft at site 3 to 76 ft at site 9, control the runoff from a total of 15,614 acres, or 52 percent of the total drainage area above Lancaster. These structures contain a total of 855,871 cu yd of fill and contracts for their construction totaled $823,110.

Other Structural Measures

Although in this watershed a good water supply is available from deep glacial deposits, two sites were chosen by the Ohio Department of Natural Resources, Division of Wildlife, to include permanent pools for fish and wildlife purposes. Structure 9 will have a 20-acre pool open to the public for fishing. In addition, the largest stabilizing structure (structure R-63) will have a 13.5-acre permanent pool above it.

A limited amount of channel enlargement and straightening was included to provide good channel allignment below each major retarding structure. In addition, some channel enlargement on the Hunters Run tributary within the city limits will be done along with improvements to the levee system on both Hunters Run and the main channel to make it conform more nearly to the flood profiles through Lancaster.

FUTURE EVALUATION

Due to the complex nature of the flood problems in this watershed and the wide range of control provided by the structural measures, this project was selected for furthur evaluation of both the physical and economic effects of the program.

A network of three recording rain gages and five standard rain gages was installed to measure precipitation on the watershed. Runoff measurements are being made by means of continuous-stage recorders installed at both sites 1 and 2.

In addition, two stage recorders were installed to measure streamflow, one on Hunters Run at the bridge on US Route 22, 1.12 miles above the confluence with the Hocking River; the other on the main stem at the South Broad Street bridge 0.4 miles below this confluence. These runoff records will provide actual hydrographs for comparison with the computed hydrographs used in developing the designs for the structural measures.

Permanent sediment ranges were established across the temporary flood area at both sites 1 and 2, and suspended sediment load data are being collected from the outflow of these two structures to determine their trap efficiency. Complete land use and cover conditions are being recorded each year for the drainage areas aboves sites 1 and 2. In addition, the land use in the balance of the watershed is being recorded on a statistical sampling basis. It is hoped that a good check can then be obtained between computed soil losses and estimated delivery rates and the amount of sediment actually delivered to the structure sites.

SUMMARY

Within the past 25 years flood prevention work in the United States has grown from concentrated efforts in flood control measures on our major rivers to including measures for preventing floods in our myriads of tributary streams affecting both agricultural and urban properties.

Likewise, the upstream flood prevention programs have expanded from major emphasis on erosion control by means of various land-treatment practices to including structural measures for stabilizing eroding water courses, retarding flood flows, and improving channel capacities.

Emphasis has changed from federally initiated programs to programs initiated and directed by local communities.

The Upper Hocking pilot watershed in Ohio is a working example of the current approach to upstream flood prevention work. Besides the land treatment work which has its greatest effect upon reduction of erosion and sediment damages in the watershed, 22 stabilizing structures were included along with eight floodwater-retarding structures to control a total of 52 percent of the drainage area above the city of Lancaster.

The designs for the floodwater-retarding structures were based on the location of the flood damages and types of storms causing the damages. Controls for the agricultural flood damages were based on controlling the more frequent smaller floods, whereas the controls needed to prevent serious damages in Lancaster were based on controlling the more infrequent major floods.

The Upper Hocking watershed effectively demonstrates the soundness of a complete upstream flood-prevention program. The evaluation program included in this watershed will provide valuable data concerning rainfall-runoff relationships, gross erosion and sediment transport rates, the effects of land treatment on both runoff and sediment production, and the effects of the structural measures on reducing peak rates of runoff and trapping sediment.

The project demonstrates the opportunities that exist to help develop similar programs in the thousands of other upstream watersheds throughout the nation. In just a little over six years since the passage of Public Law 566, known as the Watershed Protection and Flood Prevention Act, in August, 1954, almost 1,400 applications have been received by the Soil Conservation Service from local communities for assistance in developing and carrying out similar upstream watershed protection and flood prevention work. About six hundred of these have been approved for planning, of which almost three hundred are approved for installation of the planned measures.

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Role of Feedback in Automatic Machinery

A step closer to the function served by the human mind

Patrick H. McDonald, Jr.

IN virtually every field of contemporary technology there are powerful motivations toward increased use of automatic machinery and automatic-control techniques. This trend is now more than thirty years old, having been pioneered by assembly-line thinking in automotive manufacture, continuous and batch process production in chemical and allied industries, and the design of navigation, stabilization and detection apparatus in aircraft evolution.

Today developments in this area, which has achieved the status of a science in its own right, are worldwide and penetrate almost every technical discipline and many commercial and business activities as well.

Many of the reasons for this explosive growth are so obvious as to have become trite. From a logistic point of view, the science of automatics permits operations on a scale many times larger and more complex than is otherwise possible. On the economic side, the attractive reduction in costs, in the face of rising labor problems, makes automation a natural choice for manufacturing. To the engineer, confronted with the space age and its requirements of exceedingly close control, remote operations, and optimum analysis, the automatic machine offers the only hope of meeting the transcendent demands of design needed to move nature.

It is obviously impossible, without writing a treatise on the subject, to consider all the details which relate to the analysis of such systems. It is, however, convenient to note that the central concept of all automatic apparatus is the ability of such machinery to exhibit other than a purely mechanistic or deterministic response.

An ordinary machine does only what it is designed to do. A lever is actuated or a push button is pushed, and one and only one response is forthcoming. Said in other words, the action of an ordinary machine proceeds according to the laws of mechanics, once the initial conditions are established.

But automatic machinery is expected to do more than this. In a sense, it is required to "think"—to perform the design function irrespective of the additional stimuli it may receive in the process. It is thus "liberated" from the purely mechanical response demanded by natural laws and so is autonomous.

This "thinking" function of the automatic machines can be expressed in more precise terms by noting the following properties:

Paper presented at the Winter Meeting of the American Society of Agricultural Engineers at Memphis, Tenn., December 1960, on a program arranged by the Power and Machinery Division.

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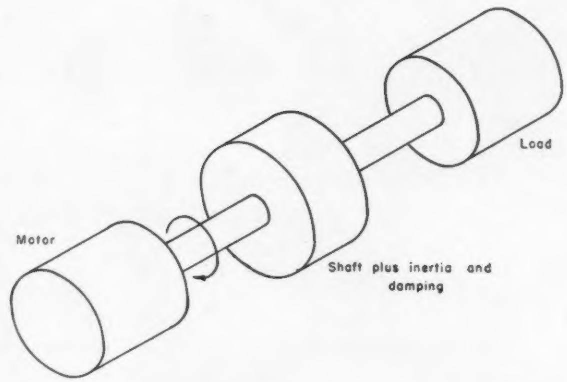

Figure 1

1 The machine must sense the result of its actions and use its findings to take corrective measures.

2 It must operate without regard for external disturbances.

3 An automatic machine must have the capacity to correct errors or minimize the difference between desired result and obtained result, all with great accuracy and high speed.

The Concept of Feedback

The generalized descriptions given above are simply a way of introducing the concept of feedback in automatic machinery. The idea can be further visualized by taking as an example a simple system described by a first-order linear differential equation.

Consider first the case in which there is no feedback, only a mechanistic response. Let there be taken from some piece of machinery a rotating "shaft" with entrained mass moment of inertia I, viscous damping constant c, and nominal rotational speed Ω. Suppose further that all "torques" acting on the "shaft" are regulated as perfectly as possible, but that there exists always a small error between the torque applied to the shaft and that absorbed by the load.

Then the system can be represented by

$$I\,(d\omega/dt)+c\omega=T(t) \quad . \quad . \quad . \quad . \quad . \quad [1]$$

in which ω is the variation in speed about the steady value Ω, and $T(t)$ is the error torque.

The solution of equation [1] consists of two parts, the complementary function corresponding to

$$I\,(d\omega_c/dt)+c\omega_c=0 \quad . \quad . \quad . \quad . \quad . \quad [2]$$

and a particular integral obtained from

$$I\,(d\omega_p/dt)+c\omega_p=T(t) \quad . \quad . \quad . \quad . \quad . \quad [3]$$

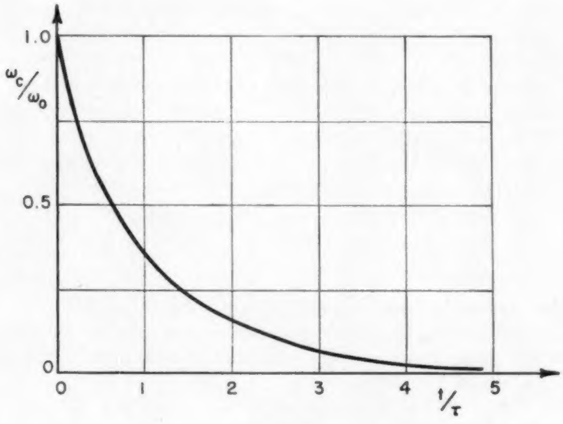

Figure 2a

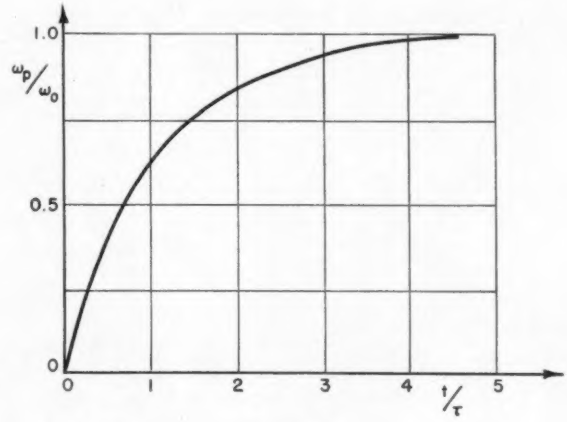

Figure 2b

so that $\omega=\omega_c+\omega_p$ . . . . [4]

The complementary part is

$$\omega_c=\omega_o e^{-t/\tau} \quad \tau=(I/c) \quad . \quad . \quad . \quad . \quad . \quad [5]$$

The form of the particular integral is directly dependent upon the character of the exciting torque, but much insight into the nature of the response is obtained by considering what happens if a constant torque T_o is suddenly applied at time zero. Under this excitation the particular integral is

$$\omega_p=(T_o/c)\,(1-e^{-t/\tau}) \quad . \quad . \quad . \quad . \quad . \quad [6]$$

These elementary solutions are sketched in Fig. 2 and it is clear that the response of the shaft is governed by a characteristic time τ. That is, a period of time equal to about 3 τ is required for the shaft to achieve the asymptotic value of its final speed.

Now the entrained inertia of a shaft is ordinarily a very large quantity, and mechanical damping is often a very small quantity, so that $\tau=I/c$ is evidently a long period of time. That is to say, any errors in speed of the shaft will require a long time to correct, and in addition the error torque must be very small since, from equation [6], it is magnified by the ratio I/c.

Consequently, the purely mechanistic device is a very unsatisfactory solution in any design which requires rapid and accurate response.

In contrast, the same system utilizing a feedback element presents a very different picture. Suppose, then, that the "shaft" speed is sensed by a velocity transducer which actuates a torque reduction in the drive motor which is proportional to the speed variation ω, Fig. 3.

The equation comparable to equation [1] for this machine is

$$I\,(d\omega/dt)+c\omega=T(t)-\beta\omega$$

$$\text{or } I\,(d\omega/dt)+(c+\beta)\,\omega=T(t) \quad . \quad . \quad . \quad . \quad [7]$$

and it is seen that $c+\beta$ stands in the place of c in the previous solution.

The response time is now $\tau=I/c+\beta$, and the magnitude of the speed variation is proportional to $T_o/c+\beta$. It is very easy to make β large compared to c, and hence it is easy to improve the speed of response and to reduce the magnitude of the undesirable speed variation.

So a little feedback makes a dramatic improvement in the performance of this simple machine, and it is also evident that this improvement is accomplished by the machine itself. It has in fact begun to "think," or it is automatic.

Extension of the Feedback Concept

The elementary example cited above demonstrates the fundamental role played by feedback in an automatic machine. Naturally it is possible to extend this concept to more elaborate and complex arrangements. Other forms of excitation can be introduced, higher order systems such as mass-spring-dashpot devices governed by equations of the form

$$m\,(d^2s/dt^2)+c\,(ds/dt)+ks=F(t) \quad . \quad . \quad [8]$$

can be considered, and non-linear mechanisms can be investigated. An example of the latter is furnished by the double-sided hydraulic actuator shown schematically in Fig. 4, the equation of motion of which turns out to be as follows:

$$dv/dt=c_1-c_2v^{7/4} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad [9]$$

$$\text{with } c_1=g/W\,(P_0A_1-P_3A_2-W-f) \quad . \quad . \quad . \quad [10]$$

$$c_2=\frac{0.241\,g\rho v^{1/4}}{W}\left(\frac{l_1A_1^{11/4}}{d_1^{19/4}}+\frac{l_2A_2^{11/4}}{d_2^{19/4}}\right) \quad . \quad . \quad [11]$$

Here again the system performance can readily be improved by feedback. In this instance a velocity transducer is used to sense the motion of the mass, and a fraction of the variation from desired speed is used to reduce the pressure applied at the control valves.

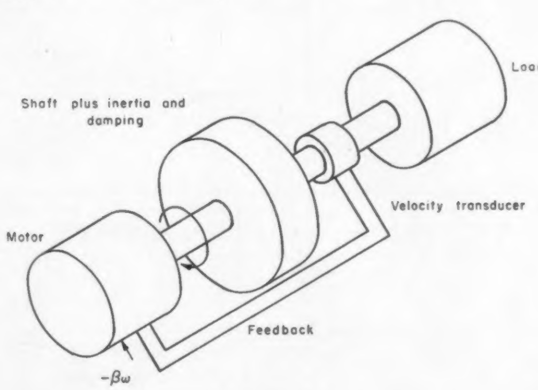

Figure 3

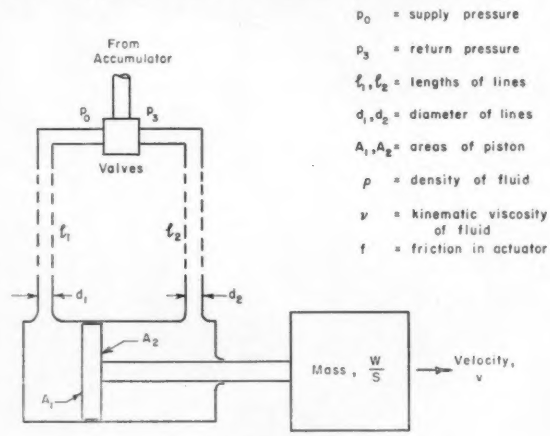

Figure 4

However, in the case of non-linear systems, the solutions to the equations of the system, with or without feedback, are ordinarily effected by numerical or graphical means, since closed-form analytical answers are seldom known.

A further degree of complexity in the application of feedback to automatic machinery comes about by regarding the many-variable system. It is then possible to employ feedback between variables, as well as for a given variable.

In many instances an automatic machine or its elements are characterized by equations which have variable coefficients. Such systems present additional complications with respect to stability of response.

The Ultrastable Autonomous System

It seems clear that the extension of feedback concepts to more complex systems as mentioned above leads to ever more complex analyses and designs. Systematic development of criteria for analysis, prediction of response, stability, and synthesis become increasingly more difficult to effect, and there is considerably more doubt concerning reliability.

The engineer concerned with the selection of components and optimizing the performance of complex automatic machines is presented with the dilemma of error, when accuracy is required, and instability, when the need is reliability.

Happily, there is still the possibility of an automatic device, using feedback principles, which "thinks" for itself so well that it even compensates for some of its designer's mistakes. This machine is called the ultrastable autonomous system.

To illustrate, take the system of two variables

$$dx/dt = ax - by \quad . \quad . \quad . \quad [12]$$

$$dy/dt = cx - ay \quad . \quad . \quad . \quad [13]$$

in which a, b, c are constants which depend upon an auxiliary parameter λ. These equations represent a mechanical system such as two shafts with inertia and damping and cross-feedback between the two.

To proceed with an analysis of the system, note first that there exists between the variables the equation

$$2c \times dx - 2a\,(x\,dy + y\,dx) + 2b\,y\,dy = 0 \quad . \quad [14]$$

An immediate integral is evident in the form

$$cx^2 - 2axy + by^2 = K \quad . \quad . \quad . \quad [15]$$

where K is an arbitrary integration constant. By differentiating equations [12] and [13] and using [14], one finds

$$d^2x/dt^2 + \omega^2 x = 0 \qquad \omega^2 = bc - a^2 \quad . \quad . \quad [16]$$

$$d^2y/dt^2 + \omega^2 y = 0 \qquad \omega^2 = bc - a^2 \quad . \quad . \quad [17]$$

so that $x = A \cos(\omega t + p)$ . . . [18]

$$y = B \cos(\omega t + q) \quad . \quad . \quad . \quad [19]$$

if $\omega^2 > 0$ and

$$x = C \cosh(\omega t + r) \quad . \quad . \quad . \quad [20]$$

$$y = D \cosh(\omega t + s) \quad . \quad . \quad . \quad [21]$$

if $\omega^2 < 0$. In the former case the motion is a stable oscillation of both variables; in the latter instance the motion of both quantities diverges or is unstable. Equation [15], for the stable case $\omega^2 > 0$, is that of an ellipse. Hence its plot in phase space shows the limit cycle illustrated in Fig. 5*a*, whereas the system response for $\omega^2 < 0$ is an hyperbola in phase space, Fig. 5*b*. The exact features of the curves are established by the particular values of the constants a, b, c, and it may be recalled that these are in turn functions of a parameter λ.

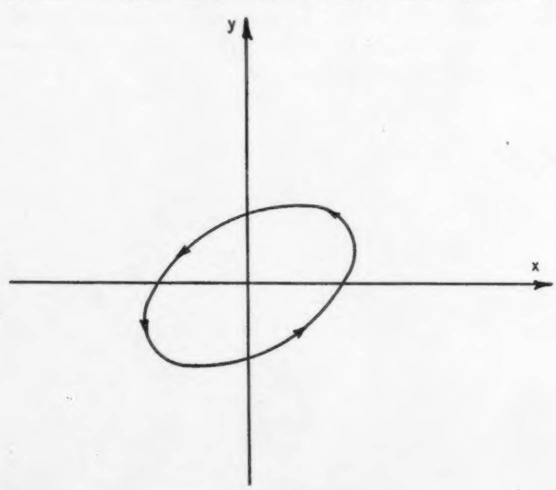

Figure 5a

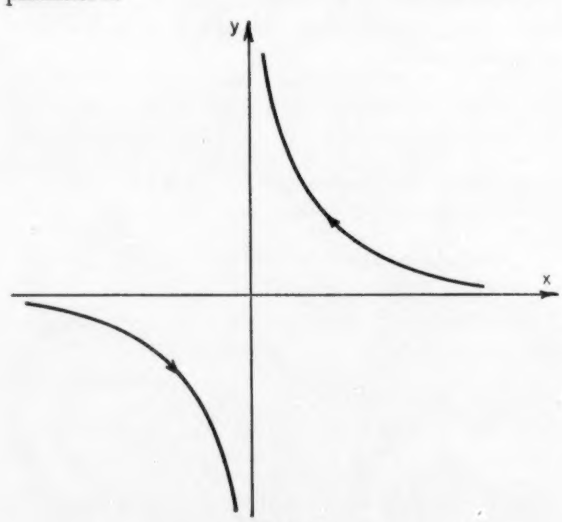

Figure 5b

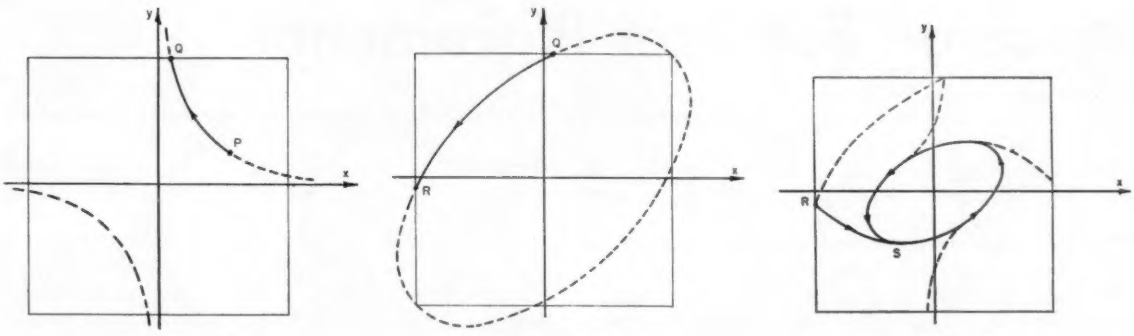

Figure 6a Figure 6b Figure 6c

Now imagine that an automatic machine is required which will give a stable operation irrespective of the values of *a, b, c*. Assume also that there exist extreme values of the variables *x* and *y* beyond which a satisfactory performance does not exist. This latter requirement establishes a fixed boundary in phase space, and the additional equipment needed to transform the ordinary two variable system with feedback into the ultrastable autonomous machine is a limit switch and feedback in the parameter λ.

The operation is as follows (See Fig. 6*a*, *b* and *c*): Starting with a parameter λ_1, which gives constants a_1, b_1, c_1, a designer's choice, and under specified initial conditions, the system point *P* moves along an unstable path to *Q* (Fig. 6a), at which time a limit switch operates (because the machine has reached its extreme value beyond which it must not work). A new choice of the system parameter λ_2 is made (by feedback) to give a_2, b_2, c_2, and this time the machine selects a stable path *Q* to *R* (Fig. 6b). But the path selected requires the system point to go outside the boundary, which it may not do, so the limit switch operates again, and a third choice of λ, namely λ_3, is obtained.

Assume that this time the choice gives rise to constants a_3, b_3, c_3, for which a stable limit cycle exists totally within the acceptable boundary. The system point moves from *R* to *S* (Fig. 6c), and thence around the ellipse continuously.

In this fashion the machine has "thought" its way forward to a happy function, even to the extent of redesigning itself to fulfill the intended role.

Summary

The role of feedback in machinery is to make the machinery automatic, and the role of feedback in automatic machinery is to bring automatic machines a step closer to the function served by a human mind.

. . . Field Production of Hay Wafers

(Continued from page 415)

tain physical conditions in wafered forages which must be met to achieve successful production of field wafers. These conditions include preprocessing the hay to provide a uniform windrow of homogenized material which can be fed continuously and uniformly to the wafering die. Control of the moisture content of the hay is obtained by careful curing in the windrow and the addition of moisturizing agents as are needed to form good wafers. The shredding-mixing action on the plant material gives better bonding. The flail pickup on both the hay conditioner and the wafering machine assures double safety factors in being able to detect any foreign objects before they enter the machine as well as helping to give a uniform flow of material to the wafering mechanism. In the development of the prior art, the wafering machine utilizes a stationary open-type die having multiple-die throats and wafering chambers. Rotating pressure rollers are used in conjunction with a twin-flight feed auger for feeding the wafering die. When rotating at the proper speed, the auger distributes the field-cured preprocessed forage materials ahead of the pressure rollers in a uniform and continuous manner. It is possible to control the rate of work of the individual wafering chamber by the manner in which the hay materials are fed into the precompression chamber. This is called the "timing" action. The rotating auger and arm assembly develops the centrifugal action which moves the material outward toward the front of the rollers. The open-die design gives high capacity. Wafer size may be 2 x 2 in. or 1 x 2 in. Length of the wafers can be varied by machine adjustment. The 158 sq in. of throat space and the length of the wafer-forming chamber provide time (5 sec) for the proper pause action. The automatic, controllable die gives instant control for density of wafer and allows for opening action of the die throats to avoid permanent setting or plugging of the die chambers. Wafers produced by the machine have a bulk density of 25 lb per cubic foot. They have been successfully stored with and without artificial drying. Best moisture content will vary from 14 to 18 percent.

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Precision Fertilizer Placement

Engineers develop accurate and timesaving metering equipment

J. G. Futral
Member ASAE

THE heavy red soils of the Southern Piedmont Region require large amounts of fertilizer for good yields. Due to their derivation and the high average temperature and humidity of the region, they are relatively infertile and low in organic matter; consequently, standard fertilizer recommendations for row crops usually exceed 600 lb of high-analysis fertilizer per acre at planting. Since broadcast applications are inefficient due to fixation, band placement of fertilizer near the seed is preferred. The distance is critical since severe injury to seed and seedlings occurs when salt concentration becomes too high. Assuming a standard placement of a single band of fertilizer 2 in. to one side of and 2 in. below the seed, a decrease in depth of ½ in. will mean a 12 percent decrease in fertilizer-to-seed distance and an increase of over 28 percent in salt concentration under some conditions.

A research program on fertilizers and their placement requires both an accurate metering method and a means of maintaining a consistent relationship between seed and fertilizer. This can be accomplished by mounting properly designed equipment on a tractor that is heavy enough to maintain a constant speed with little slippage under any loading used for the experimental work.

Solid Fertilizers

Commercial fertilizer hoppers may vary as much as 50 percent in their output rate even when a uniform material is used. This fact, plus the difficulty of calibrating them for large numbers of experimental mixtures which vary in density and condition, makes their use impractical. Even the top-delivery hopper gives a varying output under some field conditions. The development of the belt metering hopper introduced a great improvement in research equipment, but its accuracy depends upon the accuracy with which fertilizer is distributed along the belt. Under field conditions, a high degree of precision is not always obtainable even with special loading equipment. Also, these hoppers are difficult to mount and are prone to damage when the unit is transported by truck driven over rough terrain.

An experimental planter developed in Canada(1)* suggested a design for satisfactory metering hoppers. The completed unit has proved to be easy to load and has cut the time required for putting out complex fertilizer tests in half. The largest error yet found for any increment of row is 2 percent.

Paper presented at the Winter Meeting of the American Society of Agricultural Engineers at Memphis, Tenn., December 1960, on a program arranged by the Power and Machinery Division. Approved as Paper No. 385 in the Journal Series of the Georgia Experiment Station.

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Acknowledgment: The author thanks J. L. Butler for his suggestions and help in the design and construction of the solid hoppers, and J. T. Reid for his help in the construction of the liquid unit.

*Numbers in parentheses refer to the appended references.

The hopper of this unit consists of a flat circular bottom attached to a vertical shaft. The shaft is geared to the tractor planter drive to produce one rotation per plot length. Fastened to the bottom is a 45-deg cone concentric with the shaft. A loading cylinder rests on the top of the cone and is free to slide in a vertical direction when lifted. The base is enclosed by a stationary side with a scraper attached. In use, a weighed or measured portion of fertilizer is poured into the loading cylinder. The cylinder is then lifted slightly allowing the fertilizer to be distributed uniformly around the circumference of the base. The scraper removes the fertilizer into a standard flexible fertilizer tube as the hopper bottom rotates while the tractor is being driven. Different ingredients may be loaded in succession and will be mixed when delivered, thereby eliminating premixing of different fertilizers. By mounting the hoppers on a base furnished as standard tractor equipment, and by making certain that the additional chain drive needed to gear down the hopper to one revolution per plot length may be quickly disconnected, the tractor may be easily converted from a research to a field unit in a few minutes.

Plans and a complete description of this unit have been published and are available(2). Fig. 1 shows the unit in use. The average time required for a trained three-man team to fertilize and plant a four-row by 50-ft plot is one minute. For routine work such as side dressing, the time required is even less since provision can be made for the entire team to ride the tractor instead of walking beside it.

These hoppers may be attached to subsoil plows for deep placement work if a separate ground-traction drive is used. In addition, they may be used for precision metering of other materials such as insecticides.

Liquid Fertilizers

The advent of liquid fertilizers brought about the need for a positive metering device which would be independent of ground speed and which could be easily calibrated for

Fig. 1 The precision fertilizer unit developed at the Georgia Experiment Station in process of being loaded for applying one liquid and two solid materials while planting

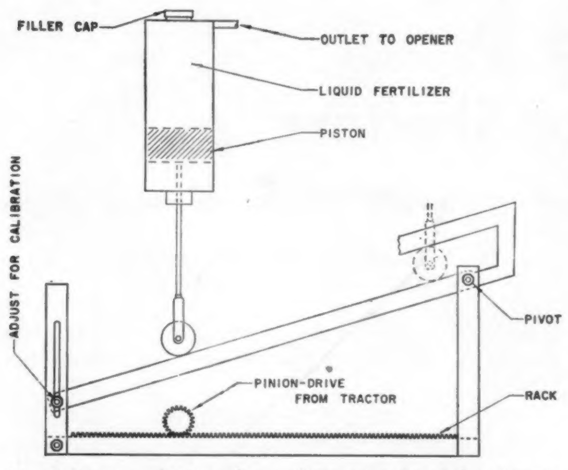

Fig. 2 Diagram showing the working principle of the Georgia Experiment Station precision liquid fertilizer distributor

different volumes. A schematic diagram showing the working principles of such a device is shown in Fig. 2.

Basically the unit consists of a cylinder, the volume of which is large enough to contain the largest amount of liquid material to be used for a plot row. A piston is driven upward by the action of an inclined plane, which in turn is moved by a rack and pinion driven from the tractor planter gears. The drive is geared to move the rack its full stroke in one plot length. Not shown are a simple clutch and crank attached to the pinion for returning the rack to its original position after completion of each row. The length of the piston arm is adjusted so that the top of the piston coincides with the top of the cylinder at the highest point of the inclined plane. In use, the rack is cranked back until the piston is at its lowest position; then the correct volume of liquid is poured into the cylinder. Next the inclined plane slide is raised, which also raises the piston, until the liquid level coincides with the top of the cylinder. It is then locked at this angle. Since the rack always moves its full stroke in a plot length, the piston has to end up even with the cylinder top regardless of its starting point or of the original volume used.

This unit has been used in conjunction with the solid units for combination tests. About 15 seconds are required to rewind and fill the cylinder at the beginning of each plot row. Calibration takes about 30 seconds.

Since no detailed plans have been published, there are three essentials to consider in the construction of this unit. The rack must run off of the pinion or be declutched accurately at the end of each plot to prevent damage. The highest part of the inclined plane must be rounded to prevent the piston from striking the cylinder top after angular adjustment, and very strong guides must be provided for the piston arm to resist lateral forces produced by the action of the inclined plane. The output may be divided accurately between two rows only if siphon breakers are used on the tubing to compensate for differences in length or height.

Openers

The equipment described above is for research purposes only. The requirements for fertilizer openers are the same for both research and field-scale operation. The openers should be mounted so that any variation of the set distance from the fertilizer band to the soil surface and to the seed is at a minimum. For use in heavy clay soils, good results have been obtained by the use of curved openers, which provide considerable suction, mounted directly to tractor tool bars controlled by a double-acting hydraulic system. The planters are mounted separately so that variations in angle of the tool bars caused by pressure do not affect depth of planting. In addition, the planter openers are made strong enough to resist lateral displacement.

For placements deeper than 8 in., a subsoil plow set to provide considerable suction has given the greatest uniformity. At these depths it is not essential to plant while applying fertilizer since slight variations in driving produce a relatively small percentage of error in seed-to-fertilizer distance.

Work reported in Oklahoma(3) has shown that a minimum of soil disturbance from opening feet aids in obtaining good stands. This should be considered when designing fertilizer openers and, for the same reason, it is advisable to put out the fertilizer just ahead of the seed openers since this allows a more nearly uniform seedbed.

Both research and field scale equipment should be designed so that a wide variation in placement positions may be easily obtained. Although the most common recommendation is to place fertilizer 2 to 2½ in. to one side of, and the same distance below the seed, it may be unsuited for some crops and soil conditions. For example, on sandy land, these distances may need increasing; and recent unreported work by the author indicates that fertilizers for some crops are more efficient when placed 8 to 12 in. deep.

Conclusions

Experimental errors in fertilizer and fertilizer placement work are apt to be high unless precision metering equipment is used. Accurate positioning of the fertilizer band with respect to the seed is as essential for farm use as for research use. The metering equipment described has proved to be accurate and timesaving. The suggestions made concerning the strength, positioning, and adjustment of openers have proved satisfactory for a wide range of soil conditions.

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1961 TRANSACTIONS of the ASAE

THE General Edition of the 1961 TRANSACTIONS of the ASAE, Vol. 4, No. 1, containing 152 pages is off the press. Copies are available at $6.00 each ($3.25 to ASAE members). The second edition, containing at least 96 pages, will be a special edition devoted to technical articles on Power and Machinery subjects and will be published later in the year. Copies of the special edition will sell for $4.00 each ($3.00 to ASAE members). Combined price for both editions is $8.00 ($5.50 to ASAE members).

Evaporative Cooling of Animal Shelters

Basic engineering principles of fog or mist cooling systems

T. F. Maher and G. L. Nelson
Assoc. Member ASAE *Member ASAE*

IN recent years considerable interest has developed in methods of providing summer comfort for livestock in an effort to obtain more economical production. Evaporative cooling systems have become popular for this purpose in regions where the summer air normally has a low degree of saturation. In the evaporative cooling process, a reduction in dry-bulb air temperature is realized by utilizing part of the heat content of the air to provide latent heat of vaporization of water. A reduction of 20 degrees or more is theoretically possible for typical summer weather conditions in many areas.

An evaporative cooling system employing a water saturated pad of finely shredded wood fiber and a fan or fans arranged to move air through the pad has become popular. This system normally is used in a structure sufficiently airtight to insure suction on the pad. In the fog or mist system, the water to be evaporated is broken up into very fine drops by a nozzle of suitable design and sprayed into the air that is to be cooled. The fog or mist system may be installed in an open-type shelter and used in conjunction with natural ventilation. There appear to be numerous variables that influence the operation of this system, and there is a lack of information on what constitutes a good design.

Paper presented at the 1960 Winter Meeting of the American Society of Agricultural Engineers at Memphis, Tenn., December 1960, on a program arranged by the Farm Structures Division.

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PREVIOUS INVESTIGATIONS

Work reported by earlier investigators on the use of fog or mist for livestock cooling has been concerned primarily with the changes that take place in the animal being cooled. Various benefits have been reported (1, 2, 3, 4)* when fog was used to cool several classes of livestock. Certain system variables such as nozzle pressure, orifice diameter, cone angle, and nozzle direction are easily changed in a fogging system; yet little information is available to indicate the relationship between such variables and air-temperature reduction. The present study was undertaken to develop a method of predicting the performance of a fogging system when one or more of the variables governing the system are changed.

The variables that have been considered as governing various parts of a fogging system have been reported in the literature. Ranez and Marshall (5) developed an expression for predicting the heat transfer to spherical drops having a velocity relative to the surrounding fluid. McLain and others (6) developed a method of calculating drying time and drying distance for drops in a jet spray drier. The variables influencing the size of drops produced by a spray nozzle have been studied in some detail (7, 8).

*Numbers in parentheses refer to the appended references.

TABLE 1. PARTIAL LIST OF PERTINENT VARIABLES IN THE PERFORMANCE OF A FOG OR MIST COOLING SYSTEM

No.	Symbol	Description	Units	Dimensional notation
1	D_o	Diameter of nozzle orifice	ft	L
2	V_a	Average velocity of airstream flowing past nozzle	ft/sec	LT^{-1}
3	ΔP	Pressure drop across nozzle orifice	lb(F)/ft^2	FL^{-2}
4	$T_o - T_{wb}$	Wet-bulb depression	deg F (abs)	θ
5	Q_w	Discharge rate of nozzle	lb(M)/sec	FTL^{-1}
6	X	Horizontal distance to nozzle measured perpendicular to flow	ft	L
7	Y	Vertical distance to nozzle measured perpendicular to flow	ft	L
8	Z	Distance downstream from nozzle measured in direction of mean flow	ft	L
9	$T_o - T_{xyz}$	Dry bulb temperature reduction (Difference between outside dry bulb temperature and dry bulb temperature measured at position X, Y, Z in the airstream downwind from nozzle)	deg F(abs)	θ
10	T_o	Dry bulb temperature of incoming air	deg F(abs)	θ
11	Q_f	Drop fallout rate	lb(M)/(ft^2-sec)	FTL^{-3}
12	W	Width of enclosure	ft	L
13	H	Height of enclosure	ft	L
14	g	Acceleration due to gravity	ft/sec^2	LT^{-2}
15	ρ_a	Density of air	lb(M)/ft^3	FT^2L^{-4}

NOTE: The F-L-T system has been used in this study. Variables that customarily include mass have been transformed to the F-L-T dimensional system by use of Newton's second law of motion.

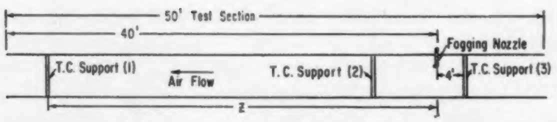

Fig. 1 Position of nozzle and thermocouple supports in test section

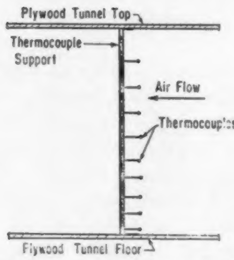

Fig. 2 Thermocouples mounted on supports

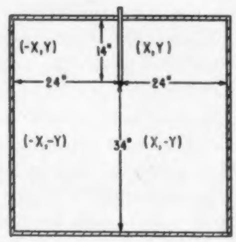

Fig. 3 Position of nozzle in tunnel

EXPERIMENTS

The experiments in the present study were organized according to principles outlined by Murphy (9) and Langhaar (10) based on the Pi Theorem due to Buckingham (11). The objective of the investigation was to determine relationships existing among certain variables pertinent to the operation of a fog cooling system that would be useful for design purposes. Work of previous investigators and certain laws of physics and psychrometry indicated variables that would be pertinent to the operation of a fog or mist cooling system. The variables used in the present study were chosen to simplify the experimental part of the study and do not necessarily constitute a unique set.

A complete listing of the variables and pi terms or dimensionless parameters considered in the study is given in reference 12. Variables used in this paper are shown in Table 1 and the dimensionless parameters formed from these variables are shown in Figs. 4, 5, 6, and 7. In studies concerned with temperature reduction, π_1 (Fig. 4) was considered the dependent quantity. In studies dealing with drop fallout, π_{11} (Fig. 7) was considered the dependent quantity.

The experimental phase of the study was conducted in a low-velocity wind tunnel located in the agricultural engineering laboratory at Oklahoma State University. A view of this tunnel and part of the experimental equipment is shown in Fig. 8. The geometry of the system is shown in Figs. 1, 2, and 3.

A 48-point, self-balancing potentiometer with iron-constantan thermocouple sensing elements was employed to measure temperatures. In general, three replications of temperature readings were made. The drop fallout rate was determined in a separate study by weighing the water caught on strips of blotting paper placed on the tunnel floor perpendicular to flow. Samples of fallout were caught on the blotting paper at four-foot intervals downstream from the nozzle.

The general procedure in conducting the experiments was to measure the value of the dependent parameter while one of the independent parameters was varied over the desired range. During the process, all other parameters considered to have an important influence on the dependent parameter were held constant. For example, in the temperature studies, one of the parameters containing a variable, over which some control could be exercised in the design or operation of a fog cooling system, was allowed to take on a range of values. For each new value the temperatures involved in π_1 were measured. A plot was then made of the experimental data and the relationship between π_1 and the independent parameter determined.

RESULTS OF EXPERIMENTS

Temperature Studies

The functional relationship that existed between $\pi_1 = T_o - T_{xyz}/T_o$ and certain of the other pi terms was found to depend largely upon the point where T_{xyz} was determined. Increasing the air to water ratio by increasing air velocity did not necessarily reduce π_1. Fig. 4 shows a plot of π_1 vs $\pi_7 = \rho_a V_a WH/Q_w$ wherein π_7 was changed by changing the air velocity. Air velocity was the only variable in π_7 that could be changed without affecting the constancy of some of the other pi terms. The data used to plot Fig. 4 were taken at a point 39.2 ft downstream from the nozzle and for the two positions below the nozzle indicated. In both positions, the cooling effect increased as π_7 increased. The apparent reason for this was a vertical shifting of the cool air and fog as discussed later. The cooling effect was less for the position closest to the nozzle vertically as indicated by the dashed line. For a vertical position even with or above the nozzle there was virtually no temperature reduction over the full range of π_7 used.

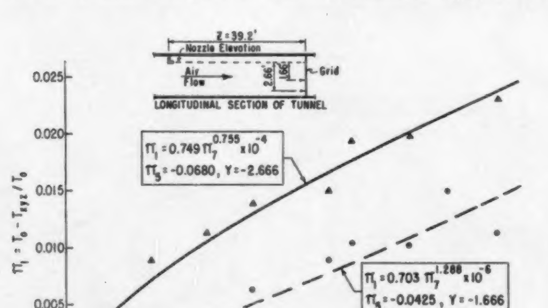

Fig. 4 Plot of π_1 vs. π_7 for two different vertical positions in the airstream

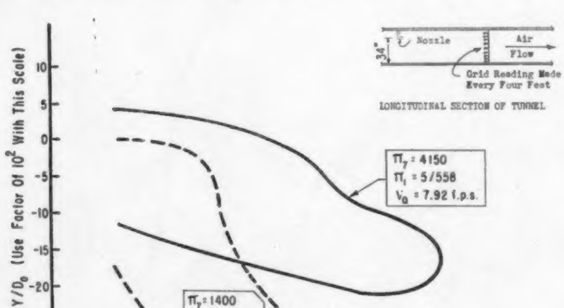

Fig. 5 Plot of lines of constant cooling effect down center line of airstream

. . . Evaporative Cooling of Animal Shelters

The data used to plot the curves in Fig. 4 appeared to fit a straight line on log-log paper. The constants used in the equations for the curves in Fig. 4 were determined by a regression analysis. The equations obtained may not be valid beyond the range of π_7 shown since rationalization leads to the conclusion that the curves must have an upper limit.

A similar study of π_1 vs π_7 was made at a point 9.75 ft downstream from the nozzle. The relationship that existed between the two terms at this point appeared to be quite complex. Depending on the vertical position of the point of observation of T_{xyz}, π_1 decreased, increased, or remained constant for a corresponding range of π_7. For certain positions π_1 remained constant for all values of π_7 used. A detailed study of the temperature distribution in the airstream was undertaken to seek an explanation for these observations.

The approximate vertical positions of the thermocouples used in studying temperature distribution are shown in Fig. 2. The grids supporting the thermocouples were moved downstream at four-foot intervals where the nine temperature readings were taken. The readings taken in this manner were used to plot (by interpolation) lines of constant cooling effect or π_1. Fig. 5 shows the results of one study where two different velocities were used. The contour lines represent constant values of π_1 at the center of the airstream. Air within the area enclosed by the contours was cooled more than five degrees. The effect of velocity is evident and helps to explain the various results obtained when π_1 was plotted against π_7. The cooled air and fog concentrated in a band having a downward slope. Vertical shifting of the band took place as velocity increased. For the position 9.75 ft from the nozzle, the band moved vertically away from the thermocouple located 2.666 ft below the nozzle and toward the thermocouples located in the vicinity of the nozzle. For certain vertical positions at this station, the thermocouples remained in the band over the full range of π_7 employed. At the station 39.2 ft from the nozzle, there was a continuous increase in π_1 for all thermocouples on the grid as the cooled air moved vertically when air velocity increased. It was noted that the vertical movement was not sufficient to affect π_1 appreciably for positions above the nozzle height.

Fig. 6 shows the position of the same π_1 contour line at a cross section of the airstream when two different airstream velocities were used. At the higher velocity the cooled air was evidently contained in an area near the center of the stream. The lack of complete symmetry of the pattern is attributed to the influence of outside wind conditions. On certain days wind blowing around the building and over a large stack located on the left side of the tunnel discharge chamber appeared to set up a slight pressure differential that caused the evaporating fog to deviate from the center line of the tunnel. Horizontal spread of the cooled air appeared to be considerably greater at the lower velocity. The dip in the contour line at the center was a peculiar result obtained at velocities less than about four feet per second. The dip was evidently caused by more rapid settlement of the drops at the center of the airstream than at the edges. Perhaps there was more recombination of drops at the center of the stream and less temperature difference between drops and air than at the outside edge of the airstream where drop concentration was lower. Both of these factors would cause more rapid settlement of drops at the center of the airstream. This was further indicated by the fact that the fallout patterns on the tunnel floor consistently showed that drops traveled further downstream along the edges of the stream than at the center for velocities less than about 4 fps. For a value of Z equal to 20 ft and for a velocity of about 3 fps, the width of the fallout pattern was approximately four feet. Increasing the velocity to about nine feet per second caused the width of the pattern to be reduced to approximately two feet. In addition, the pattern started and ended further downstream for the higher velocity.

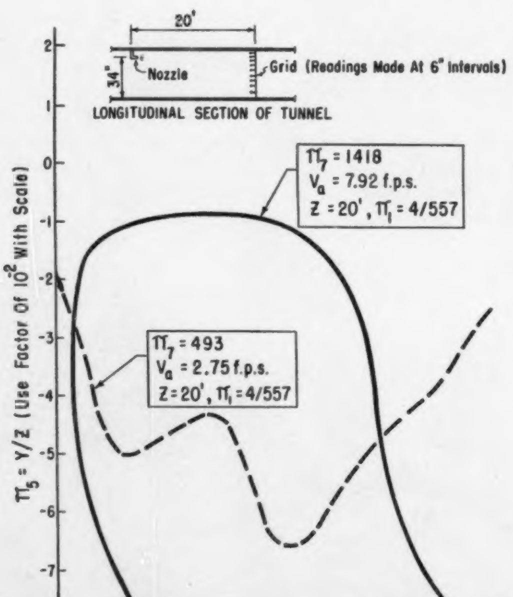

Fig. 6 Plot of π_1 vs. π_6 for values of π_7

Transportation Studies

The amount and position of drop fallout is important in the operation of most fog cooling systems. Excessive fallout often creates an unsanitary condition and a fly prob-

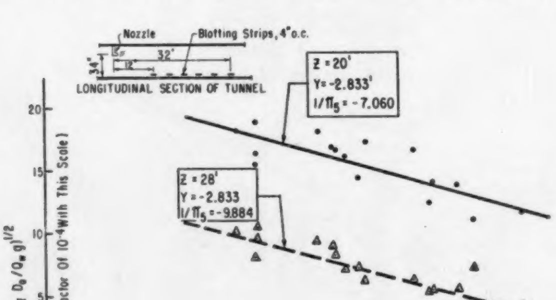

Fig. 7 Plot of π_{11} vs. π_3 for two values of $1/\pi_5$

lem. Also, drops that fall to the floor are of little benefit in reducing air temperature. Because of the spectrum of drops emitted by a pressure-type nozzle, it is difficult to prevent all fallout. Sometimes intermittent operation of the fogging nozzles is employed to allow some drying of the fallout to take place when the system is in operation. Studies of drop transportation were conducted in order to develop a relationship between π_{11} and certain other system parameters. In conducting these transportation studies, π_{11} was considered the dependent variable. Its value was determined at four-foot intervals downstream from the nozzle by weighing the water deposited on strips of blotting paper on the tunnel floor.

Fig. 7 shows a plot of π_{11} vs π_3 for two values of Z/Y. The value of Y was constant at 2.833 ft, and the two lines shown are for Z equal to 20 and 28 ft as indicated. The lines were fitted to the data by a regression analysis. If the straight-line relationship prevailed at higher values of π_3, it is unlikely that the intercept on the π_3 axis corresponding to the 20-ft station would be encountered in normal operation of the fogging system. That is, some fallout would occur at a point 20 ft from the nozzle for any expected ambient air condition. At the 28-ft station, it is quite possible that no fallout would occur on hot dry days.

An equation was developed for predicting π_{11} when π_5 and π_3 are known and the other system parameters are held constant at the values used in Fig. 7 (Table 2). This equation is

$$\pi_{11} = (0.345 - 3.637\,\pi_3 - 0.01979/\pi_5) \times 10^{-2}$$

When this equation was used to plot calculated vs observed values of π_{11}, the points appeared to be evenly distributed about a line making a 45-deg angle with the horizontal as long as the reciprocal of π_5 was restricted to a range between 4.23 and 11.3.

The relationships between the two dependent parameters, π_1 and π_{11}, and other pi terms were also investigated (12). Certain observations based on these studies appeared to be useful in the design or operation of fog cooling systems. The summary and conclusions presented later are based on results of these additional studies, as well as those described in some detail in the present paper.

DISCUSSION

Influence of Velocity on π_1

The effect of air velocity should be given prime consideration in the design of fog cooling systems. Fig. 4, 5, and 6 have been selected from a more detailed study (12) for purposes of illustration. The equations shown in Fig. 4 are valid for predicting cooling effect only when the conditions in Table 2 corresponding to the figure are met.

In general, however, cooling effect was found to increase with velocity at all points studied along a vertical line located at the center of the airstream and 39.2 ft from the nozzle for all treatments used. A temperature gradient existed from the floor upward at this point with the coolest air being next to the floor.

In the design of a fog cooling system, one may be more interested in the temperature reduction of some volume of air rather than the temperature reduction at a point. In this respect, Figs. 5 and 6 indicate that the use of higher velocities may not be the best design when one is interested in cooling next to the floor. Increasing velocity caused a horizontal contraction of the area containing air cooled a given amount at a cross section of the flow path and reduced the cooling that took place near the floor close to the nozzle. In order to cool air near the floor of a shelter, it would appear the use of high air velocity would require a closer nozzle spacing than for low air velocity (perhaps 3 ft for the 7.5 fps velocity in Fig. 6), and would make it necessary to mount the nozzle considerably upstream from the area to be cooled. For cooling the floor region of a wide building, it would seem that the most satisfactory and economical design would be obtained by using a low velocity (2.75 fps or less) and placing nozzles along the length of the flow path.

TABLE 2. COMBINATIONS OF PARAMETERS AND SYSTEM VARIABLES FOR EXPERIMENTAL INVESTIGATION AND ANALYSIS

Pi term or variable	Analysis 1 (Cf. Fig. 4)	Analysis 2 (Cf. Fig. 5)	Analysis 3 (Cf. Fig. 6)	Analysis 4 (Cf. Fig. 7)
π_2*	Downwind	Downwind	Downwind	Downwind
π_3	0.0242	0.0349	0.0323	———
π_4*	90 deg	90 deg	90 deg	90 deg
π_5	———	———	———	———
π_6	0	0	———	———
π_7	———	———	———	725
π_8*	35.950	17.175	35.950	35.950
π_9*	2190×10^6	2190×10^6	2190×10^6	2190×10^6
π_{10}	26,130	———	13,333	———
X (feet)	0	0	———	———
Y (feet)	———	———	———	2.8333
Z (feet)	39.2	———	20	———
ΔP (psig)	100	100	100	100
V_a (fps)	———	———	———	4.0
D_o (feet)	0.0015	0.0009	0.0015	0.0015
T_o (deg F)	90.3	98	97	———
T_{wb} deg F)	77	78.5	79	———

NOTE: Values belonging in blanks are indicated on the figure or the discussion relating to the figure to which reference is made in column heading.
*Not discussed in this paper, see reference (12).

Fallout Studies

A study of the following equation

$$\pi_{11}=[(0.345-0.01979/\pi_5-3.637\,\pi_3)]\times 10^{-2}$$

or

$$V_a\,(Q_f D_o/Q_w g)^{1/2}=[0.345-0.01979\,Z/Y-3.637\,(T_o-T_{wb}/T_o)]\times 10^{-2}$$

reveals that fallout may be reduced by increasing the second or third term on the right-hand side. Fallout at a specified distance from the nozzle may be reduced by decreasing the nozzle height or increasing the wet-bulb depression. As an example of the use of this equation, suppose that it be required to predict the fallout rate at a point 20 feet from the nozzle for a maximum and minimum expected wet-bulb depression when the nozzle height is four feet above the surface where fallout is measured. The operating conditions of the system are those specified in Table 2 under analysis 4. Two ambient air conditions are assumed:

Case I Dry-bulb temperature is 90 deg
Wet-bulb temperature is 80 deg

Case II Dry-bulb temperature is 100 deg
Wet-bulb temperature is 74 deg

The left side of the equation may be written $CQ_f^{1/2}$ where C is a constant fixed by the values of V_a, D_o, g and Q_w used in the study. For the conditions of the study

$$\pi_{11}=34.6\,Q_f^{1/2}\times 10^{-2}=[0.345-0.01979\,Z/Y-3.637\,(T_o-T_{wb}/T)]\times 10^{-2}$$

or after dividing by the constant and squaring both sides

$$Q_f=[9.97-0.573Z/Y-105\,(T_o-T_{wb}/T_o)]^2\times 10^{-6}$$

from which the fallout for the two cases as predicted by the equation is

26.9×10^{-6} for case I
4.97×10^{-6} for case II

It should be noted that the ratio Z/Y in this case is equal to five, which falls within the range where the equation is valid.

SUMMARY AND CONCLUSIONS

A model of a fog cooling system was studied by wind-tunnel experiments to establish relationships among the variables that would be useful for design purposes. The variables pertinent to the system were formed into dimensionless parameters for the purpose of experimentation and analysis. The following appeared to be the most important conclusions resulting from the study:

1 Increasing the turbulence of the airstream containing the evaporating drops had little effect on the total evaporation rate for the conditions of the study.

2 Increasing the air-water ratio by increasing air velocity did not necessarily result in decreased cooling at a point in the airstream. The cooled air occupied a rather narrow band within the airstream which shifted upward with an increase in velocity. The vertical thickness of a band cooled more than one or two degrees seldom exceeded two feet. The horizontal spread of the band varied with distance from the nozzle and contracted with an increase in air velocity. A typical test at a station 20 ft from the nozzle showed air cooled more than four degrees occupies a band less than three feet wide. The position of a point within the air determined whether its temperature increased, decreased, or remained constant as velocity increased.

3 The width of the fallout pattern of drops on the tunnel floor decreased as velocity increased. For a typical experiment at a station 20 ft from the nozzle, the width varied from four feet at a velocity of 2.75 fps to two feet at a velocity of 8.48 fps.

4 Increasing the nozzle pressure in a typical test from 40 to 150 psig caused the width of the drop fallout pattern to increase from 1.6 to 2.4 ft at a station 20 ft from the nozzle. Drops did not fall as soon for the higher pressure. The higher pressure pattern started 1.5 ft further downstream and was still evident 12 ft after the pattern for the lower pressure had stopped.

5 A 90-deg cone-angle nozzle was more effective in reducing the temperature of the airstream than a nozzle with a 30-deg cone angle. In one experiment, a contour line representing a temperature reduction of 5 deg and drawn at a cross section of the airstream was as much as one foot higher for the 90-deg cone compared to a similar line for the 30-deg cone angle.

6 Orientation of the nozzle with respect to the airstream was found to affect the position where maximum fallout of drops occurred. In one experiment maximum fallout occurred closest to the nozzle (11 ft) when the orientation was downwind. The downwind orientation appeared to give the best over-all performance.

7 A suggested design for maximum evaporation would be to use the highest pressure and smallest orifice diameter consistent with equipment design and economy of operation. Nozzles with a wide cone angle directed to spray downwind and air velocity under four feet per second appeared to give optimum performance.

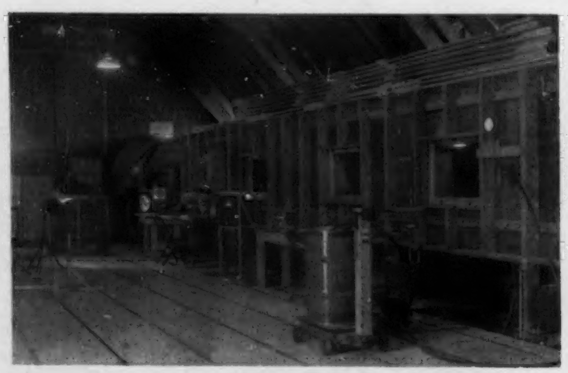

Fig. 8 A view of the wind tunnel and apparatus used in the study reported in this paper

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INSTRUMENT NEWS

A Hydraulic Soil Sampler

A portable sampler for taking undisturbed soil cores on refractory sites

J. L. Thames and R. D. McReynolds

A PORTABLE hydraulic sampler has been devised for taking undisturbed soil cores on refractory sites. It was tested in north Mississippi and found to work well in a variety of soils including loose sand and heavy clay as well as cemented Coastal Plain parent material. The fractured cores common with hand-held rotary samplers(1)* and shattered or compressed cores common with drive samplers(2, 3) were eliminated.

Steady hydraulic pressures up to 5,000 lb per square inch minimize soil disturbance by forcing the cutting edges of a sampling head slowly into the soil. A U-beam and two screw-type soil anchors provide reaction and support (Fig. 1).

The sampler (Fig. 2) is designed around a 2-ton hydraulic bumper jack, which consists of a fluid reservoir (A), pump (B), tube (not shown), and piston (C). The original jack tube was lengthened by substituting a 5-ft section of 1¼-in. galvanized pipe (D). The upper end of the tube (E) was cut and threaded to fit into a 1¼-in. pipe coupling (F). The piston bushing (G) at the other end was removed and rethreaded to fit the pipe section.

The sampler can be extended to any desired length by loosening the coupling and adding sections of pipe. Entrapped air, compressed when the fluid is pumped into the new tube section, is expelled through the reservoir when the pump valve is opened. The jack clamp (H) is modified by removing the original arm and welding on three flanges (I).

Two types of sampling heads were turned from cold-rolled steel. A tapered head (J) was designed for use in heavy or moist soil where a conventional sampler with parallel sides would be difficult to extract. The taper allows the head to be broken loose from the soil with minimum effort and easily removed. The second head, with parallel sides (K), moves into the soil with little friction and is useful in dry or compacted soils where extraction is no problem. Both heads are interchangeable and are built to contain a 3-in. soil retainer ring (L) and a ¾-in. spacer ring (M). The rings are cut from standard 3-in. automobile torque tubing at a cost of a few cents each.

The inside diameter of the rings is 0.01 in. greater than the inside diameter of the ⅛-in. lip at the cutting edge of each sampling head. Thus, friction between the soil core and the inner surface of the rings is reduced and the danger of compaction is lessened.

Fig. 1 The portable hydraulic soil sampler ready for use

The anchor shafts (N) and handles are assembled from ½-in. galvanized pipe. Steel points (O) of cold-rolled steel are press-fitted into the shaft ends. The 4-in. anchor disks (P) are $\frac{3}{16}$-in. steel cut on a radius, bent into a spiral

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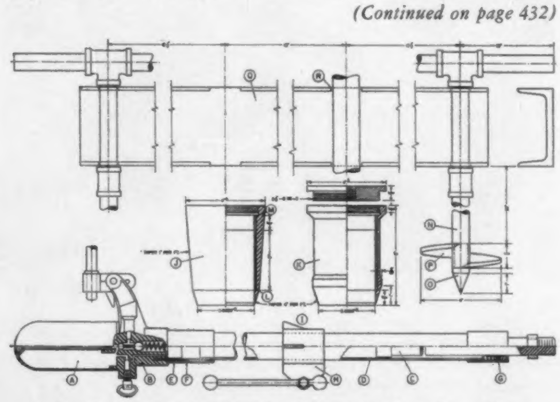

Fig. 2 Construction details of the portable soil sampler

An Instrument News Contribution from Southern Forest Experiment Station, Forest Service, USDA. Articles on agricultural applications of instruments and controls and related problems are invited by the ASAE Committee on Instrumentation and Controls, and should be submitted direct to Karl H. Norris, instrument news editor, 105A South Wing, Administration Bldg., Plant Industry Station, Beltsville, Md.

The authors — J. L. THAMES and R. D. MCREYNOLDS — are members of the staff of the Southern Forest Experiment Station, Forest Service, USDA, New Orleans, La.

*Numbers in parentheses refer to the appended references.

. . . A Hydraulic Soil Sampler

shape, and welded to the shafts. The U-beam (Q), constructed from 4-in. channel iron, has two 1.5-in. slots to permit sampling alternate depths in paired holes when consecutive 3-in. cores are desired.

The first step in operating the sampler is to auger the anchors to a depth of 12 to 18 in. in moist soils or 24 to 30 in. in dry or compacted soils. Holes are then drilled to the desired sampling depths and cleaned with a 5-in. Retzer auger. The sampler tube is placed in one of the slots (R), the clamp adjusted, and the head jacked into the soil. The sampling head unscrews from the cap in three revolutions, after which the soil core can be pushed out with the palm of the hand. The end of the core contained within the cutting lip of the sampling head and that within the spacer ring is shaved off flush with the retention ring.

Results obtained with the sampler were compared with gamma-ray scattering measurements. Cores for bulk density determinations were taken at three points near each of two gamma-probe access holes on a silt loam and a sandy loam soil. Seven depths were sampled down to 5 ft and the core densities averaged for each depth. Analysis of variance indicated no significant differences between the two methods.

Several hundred cores, ranging in bulk density from 0.98 to 1.82, were taken without breakdown.

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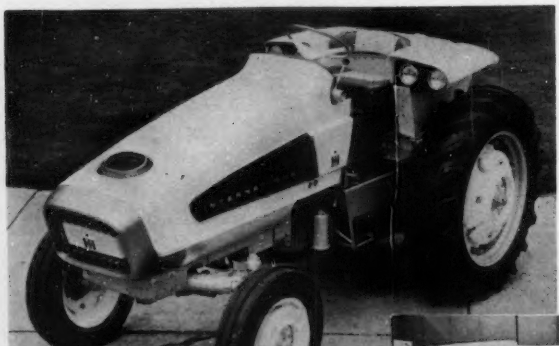
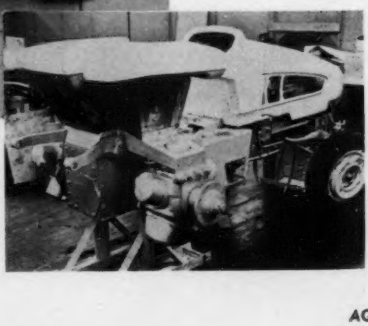
Matches Gas Turbine Engine with Hydrostatic Transmission

A SLEEK-LINED fiberglass body, a gas turbine engine and a hydrostatic transmission combine to form the nucleus of International Harvester Company's newest research farm and utility tractor. The new vehicle, called the HT-340, represents the company's latest hint of things to come in the tractor line and has no gear shift lever, no throttle, no brake or clutch pedals. It uses neither cooling water nor anti-freeze, and it has no transmission gears.

Oil consumption is reported as almost nil, and it will operate on virtually any kind of liquid fuel. Its forward and reverse speeds are infinitely variable, and, according to reports, it starts readily at low temperatures and is notably free of vibration. In announcing the new development, A. E. W. Johnson, vice-president of engineering, said, "the trend in tractor design toward increased power has a companion in the trend toward more exacting power control. The farmer of the future is going to demand the ultimate in both trends as he moves steadily away from the art and into the science of farming. So we think the gas turbine may become the natural running mate to the hydrostatic transmission. The turbine engine is capable of delivering horsepower roughly equal to its weight. And the hydrostatic transmission provides infinitely variable speed control."





New International Harvester research tractor, the HT-340, has paired gas turbine engine with hydrostatic transmission. At right, radial hydraulic motors in hydrostatic transmission system are visible. Instead of rear axle the tractor has a yoke that serves as structural member and conduit for transmission oil lines

The gas turbine, an 80-hp, single-shaft Titan T62T, is a product of the Solar Aircraft Co., a subsidiary of International Harvester Co. It is 21 in. long, less than 13 in. in diameter and weighs 90 lb with reduction gearing. The hydrostatic transmission, minus gears, shafts and splines, depends on oil at high pressure to transmit power by acting on the pistons of a radial hydraulic motor installed in each driving wheel. In operation the operator pushes a button, and an automatic sequence box takes over to connect the starter and energize solenoids. After that, except for steering, only the transmission lever is necessary to change forward and reverse speeds and to stop.

According to the manufacturer, much research must yet be completed with heat-resistant materials, fuel economy, engine noise and precise production methods before the gas turbine can become a competitive, commercial power source for a farm tractor.

. . . New Frontiers

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farmer produced enough food and fiber to support 11 people. Today he produces enough to feed and clothe 25 additional people, and these pay less real income for it than ever before in history.

But has productive success been rewarded with economic success? Hardly. The facts clearly point to the unhappy picture of a farming economy which has been rewarded with economic distress. Contrast 1947-49 with 1957-59:

New Jersey egg producers raised their net production per farm by 54 percent, but net farm income dropped 68 percent.

Eastern Wisconsin dairy farmers raised production per farm 42 percent, but income dropped 2 percent.

Wheat, other small grains and livestock producers in the Northern Plains raised production per farm 16 percent, but income dropped 28 percent.

Hog-beef producers in the Corn Belt raised production per farm 36 percent, but income dropped 28 percent.

I think it is abundantly clear that we cannot hide the shame of an economic squeeze of this proportion by pointing with pride to the fact that the number of farms grossing more than $10,000 a year has increased in the past decade. When the farmer got through paying his bills, the net income he earned in 1960 was less than what he had earned 10 years before.

I doubt that many of the agricultural engineers of this nation would work for the hourly wages which farmers have been earning in recent years. For the period 1957-60, large tobacco farmers earned an hourly wage varying from 43 cents to $1.07 after expenses. Hog-beef farmers in the corn belt varied from 27 cents to 99 cents an hour. Cattle ranchers in the Northern Plains earned 41 cents to $1.07 an hour. And these are figures for full-time commercial enterprises.

It isn't only farmers who are hurt by this inequity; the whole economy feels the pinch. Many of you are associated with firms that can verify my point — when agriculture hurts, a lot of other people hurt too. They feel the effects whether they live and work in the small rural communities or in the big manufacturing centers far removed from the farm production line.

The cutback in tractor production in 1960 to less than a third of the output in 1951 is an apt example. Many of the 55,000 workers who no longer have jobs in the farm machinery and equipment manufacturing industry can blame declining farm incomes for their plight.

The farm equipment industry has not had the growth rate which industry in general has shared. If we take 1947-49 as a base period for reference, the industry has not equalled its dollar volume of domestic shipments of farm equipment for this base period since 1952. And last year, the dollar volume of domestic shipments was only 60 percent of what it was ten years earlier.

What has this done to the equipment manufacturers? Many have become part-time farm equipment manufacturers, like their part-time farmer customers. Some have gone into making road building equipment, others into diversified industrial equipment, and others have opened branch plants in other nations to bring farmers there the benefit of science and technology.

I believe it is of more than passing interest to look deeper into the impact of declining income on the farmer and on the farm equipment manufacturer. It may produce some ideas we should consider in our quest for an answer to the farm problem.

As the net income of the farmer has gone down, his total output has expanded fantastically and his prices have dropped. Yet, as the income of the farm equipment industry has declined, output has dropped and prices for farm machinery have increased.

The reason for this difference is not hard to see. While there are over 3,000 firms making farm machinery, eight full-line farm machinery companies produce 75 percent of the annual domestic sales.

When twenty producers can supply the overwhelming portion of a market, it is decidedly easier for these firms to produce what the market needs than it is for twenty out of 3,700,000 farmers to cut back production and materially influence either what goes to market or the price which it brings.

The action of an individual farmer in cutting his production is as meaningless as taking one bucket of water out of the Mississippi River. And this is the heart of the farm problem as we know it today.

It is important that we learn from the experiences which have brought us to the crossroads in agriculture, for the decisions we make today will mean the difference between taking agriculture's foot off the brake which has retarded our national economic growth or pressing down harder on it.

The first essential lesson is, I believe, that efficiency, improved practices and cost cutting — important as they are —are not by themselves an answer to farm income problems. The second lesson is that our job is not to stop the modernization of agriculture, but to help provide a means of improving farm prosperity so that modernization can continue.

A third lesson is that the distortions which portray the farmer as a lazy, indolent and grasping individual living on handouts will not end the farm problem. It will only complicate the process of developing the means by which the farmer is fairly rewarded for his efficiency and industry.

Many people assume almost immediately that any effort to increase farm income will automatically result in a sudden, sharp increase in the price of food and clothing. However, they fail to understand that the farmer's share of the food dollar is so small now — only 39 cents last year — that moderate increases in farm prices will have little total effect on the food bill.

If, for example, the price of wheat were increased by 20 cents a bushel, the farm cost of the wheat in a pound loaf of bread would rise only one-fourth cent. If corn were increased 20 cents a bushel, the farm cost of a box of corn flakes would rise only half a cent.

And if the program to increase farm income is accompanied by the continued increase in productive efficiency, which has only begun, any increase in consumer costs because of the farmer would likely be negligible.

With this clearly understood, I want to briefly outline a five-point program which the Kennedy administration seeks to put to work for the benefit of the farmer, the consumer, the agricultural engineer and the economic health of the nation.

. . . New Frontiers

First, we must seek to make greater use of both our abundance of food and fiber and our capacity for abundance. We are taking steps currently to increase the consumption of our food and fiber abroad through an expanded export program for both dollars and for foreign currency. We expect this year to break all records for both volume and value of farm exports.

We have launched a program to determine the exact nature of the world food deficit. We now have an approximation of that deficit and currently are working on the specific dietary needs of individual countries. As we develop means — in cooperation with other countries — for the more effective use of greater quantities of agricultural exports, these new and increasing demands on American agriculture will have to be taken into account in the formulation of agricultural programs at home. This is why an extension and strengthening of our Food-for-Peace program is an integral part of the agricultural legislation now before Congress.

At home we have substantially expanded the direct distribution of food to needy families in order that they too may share in our food abundance and achieve a better diet. The administration also has launched an experimental food stamp program to permit needy families to purchase the food they need for an improved diet from the grocery store and supermarket directly. On the basis of what we learn from the eight projects which will be in operation for a year, we will determine whether it is feasible to expand this program nationwide.

The second phase of the Kennedy farm program is to make available fuller credit resources to the farmers of the nation. I am sure that you, who are concerned with the continued modernization of agriculture, recognize that a credit-starved economy cannot make full use of the inventions and improvements which you feel are vital to agriculture.

The third phase of the administration's farm program is the concentration of resources and skilled personnel within the Department in a nationwide rural areas development program. It will enable the Department to reach out and give meaningful assistance to all rural areas, especially to those of chronic farm poverty which the typical farm program does not and cannot effectively touch.

It involves both the use of low interest credit as well as a focusing of the Department's resources to provide technical assistance from all agencies of the Department to farmers and to rural communities. It is no solution to the problem to suggest that farm families who are underemployed should move to the cities. The growing concentration of population in our metropolitan areas is not convincing evidence of progress, especially when it means trading a rural slum for a city slum.

When it is practical to build up the resources of rural areas, two important gains are made: the shaky economics of small towns are strengthened and the pressure on the big cities is eased.

The fourth part of the administration's program is an increased emphasis on research to find new ways to use our farm products and to develop markets. In addition, as part of the emphasis on research, we shall continue to assist you in your efforts to develop better farm machinery for the farmer, and to increase our search into the causes and cures for animal diseases.

The fifth section of the Kennedy approach to agriculture's problems in the 1960s is to seek a realistic and acceptable means by which the farmer can adjust his production — as the farm equipment manufacturer does — to that which can be used at home and to meet the needs of hungry people abroad.

I believe that, if the American farmers are given some assurances of relatively favorable prices and incomes in the 1960s, and if we provide a sound program for adjusting our farm output, we will have a highly flexible and productive agricultural plant, one capable of responding to any foreseeable food production emergency.

You, perhaps better than any group of people, can understand that the technological revolution in agriculture has only begun. It is a picture of not simply general abundance, but of a rising capacity to produce food, feed and fiber. The pressure from production has only begun to be felt. This capacity should be fostered but it must also be managed in the interest of both farmers and the public.

We have asked the Congress for authority to work with farmers in recommending the best possible programs for each commodity, or commodity group, where assistance is needed and a practical approach can be developed. The proposed legislation provides farmers with the machinery for coming together and developing supply adjustment programs. It would provide democratic methods for approving or rejecting such programs, and it would specifically provide safeguards for consumer interests.

The program offers a variety of procedures, many of which have already proved their usefulness, in order to provide a degree of flexibility which is sorely needed by agriculture.

This five-point program in all but the rural area development and the research phases is now before the Congress. I feel that at no previous time in our history has the fate of agriculture been more at stake. It is a certainty that the structure of Congress will be shifted towards the urban and city voter in 1962; and it is doubtful that as favorable an attitude as now prevails in Congress for farm legislation will again be present.

The future of the farmer, and perhaps of your profession, and the future shape of our agricultural economy is now in the hands of the Congress. It is an awesome responsibility, and they will act knowing that only history can judge the wisdom of their decision.

I am confident that we will have a farm program through which we can begin to restore health and vigor to our agricultural economy. It is of the highest importance to this nation and to the free world — important to peace and perhaps to the survival of our civilization — that United States farmers be given the opportunity to put the agricultural house in order.

The people in your profession — the agricultural engineers — have made it clear that we can, if we wish, model the physical world to our desires. You have inspired us with the high hope that we also can develop effective social and economic instruments to adjust our agricultural abundance and close the gap between our tremendous productive potential and our ability to manage and utilize it in the best interest of all.

It will not be easy, but it can be done.

Nominations for 1962 ASAE Medal Awards

In accord with the rules governing the award of the John Deere and Cyrus Hall McCormick Gold Medals, the Jury of Awards of the American Society of Agricultural Engineers will receive from members of the Society, up to November 1, nomination of candidates for the 1962 awards of those two medals.

Members of the Society nominating candidates for either award are requested to keep in mind the purposes of each medal and make their nomination accordingly. The John Deere Medal is awarded for "distinguished achievement in the application of science and art to the soil," which citation is interpreted to cover more than a mechanistic concept of engineering, and to include chemistry, physics, biology, and any other science and art involving the soil, the "application" being acceptable to evaluation by the engineering criteria of practicality and economic advantage.

The Cyrus Hall McCormick Medal is awarded "for exceptional and meritorious engineering achievement in agriculture." Selections for the award may be in recognition of a single item of engineering achievement, but is more likely to be on the basis of the aggregate of weighted accomplishment through a continuing career.

The Jury of Awards desires that members of the Society consider it their duty and obligation to give serious thought to the matter and nominate for either or each of these awards the men they believe to be most worthy of the honor. Each nomination must be accompanied by a statement of the reasons for nominating a candidate and qualifications of the nominee, including his training, experience, contributions to the field of agriculture, a bibliography of his published writings, and any further information which might be useful to the Jury in its deliberations.

The Jury will accept and consider nominations received on or before November 1. These nominations should be addressed directly to the Executive Secretary of the Society at St. Joseph, Michigan. The Executive Secretary will supply on request a standard set of instructions for preparing information in support of nominees for the Society's gold medal awards. In fact, it is important that these instructions be followed in preparing material on behalf of any nominee.

Nominations for 1962 MBMA Award

ASAE Members are invited to nominate qualified candidates for the MBMA Award for the year 1962.

This award made available by the Metal Building Manufacturers Association and accepted in 1958 by the ASAE Council for administration by the Society, was first awarded in June 1959. Its purpose is to recognize and honor young engineers "For distinguished work in advancing the knowledge and science of farm buildings."

Features of the award iclude (a) an engrossed diploma citing the achievement or service on which the award is based, (b) a presentation watch, and (c) to the school from which the recipient received his bachelor's degree, a plaque "in recognition of its contribution to the preparation of (the recipient) for outstanding achievement.

Any member of the Society in any grade may nominate a qualified candidate for consideration for the award. Additional members may support the nominating petition by signature.

To be eligible for consideration by the Jury, a nominee must be an ASAE member in good standing under 45 years of age at the time the nomination is received at ASAE headquarters. There are no other limitations to eligibility for consideration. Nominations for the 1962 award should reach ASAE headquarters on or before November 1, 1961.

Further instructions will be furnished by ASAE headquarters on request, to any member interested in submitting a nomination.

Committee Encourages Translations

Engineers who read and translate foreign language literature in the field of agricultural engineering can provide a valuable service to others by making their translations available to others. This can be done by sending a copy of the translation, with an abstract, to the Special Library Association, John Crerar Library, Chicago 1, Ill. Those who work for the federal government should send translation and abstract to the Translation Acquisition Branch, Office of Technical Services, Department of Commerce, Washington 25, D.C. In either case, the translation will be cataloged, put on file, listed and abstracted in "Technical Translation" (published bimonthly by the Office of Technical Services), and photocopies or microfilms will be supplied upon request at a moderate price. The translation should be in reproducible black copy, and include copies of figures with translations of captions appended.

The ASAE Research Committee strongly urges all ASAE members to cooperate by sending in translations. The committee suggests that when time does not permit a thorough translation a short time spent dictating can usually provide at least a rough translation which may be quite valuable to someone else.

Agricultural Enginering Subject Matter Classification

The Agricultural Engineering Subject Matter Classification as published by the American Society of Agricultural Engineers in the 1960 edition of the AGRICULTURAL ENGINEERS YEARBOOK (pages 379-392) is now available in reprint from the Society's headquarters, 420 Main St., St. Joseph, Mich. The price is 75 cents per copy; 25 copies or more are 50 cents each.

Institute in Experimental Stress Analysis

A two-week special Institute in Experimental Stress Analysis will be given by the Engineering Mechanics Department of Wayne State University from September 11 to 22. It will be offered in two programs: Program 1 — The Theory and Application of Photoelasticity — will be offered during the week of September 11; Program 2 — Strain Gage Theory and Application — will be given during the week of September 18. Essentially, all classical experimental stress analysis topics will be presented with special emphasis on latest developments. A certificate will be awarded to participants upon satisfactory completion of one or both programs of the Institute. For more specific information contact Joseph Der Hovanesian, Institute coordinator, Department of Engineering Mechanics, Wayne State University, 655 Merrick, Detroit 2, Mich.

Indian Symposium on Agricultural Engineering

A Symposium on Agricultural Engineering was held at the Indian Institute of Technology, Kharagpur, India, on October 15 and 16, 1960. The program included papers for two sections — Section 1 on farm machinery, power processing and rural electrification and Section 2 on soil conservation, irrigation, drainage, and farm structures. Several ASAE members participated with the following papers: In Section 1 sessions—"Tillage Implement Testing Techniques", "Performance of Sugarcane Crusher", "Bibliography on Farm Implements and Power", and "Tractor Performance and Testing", by A. C. Pandya; "Evolution of Multipurpose Chassis for Agricultural Implements", by K. S. Yadav; "India's Need in Agricultural Processing and Crop Preservation", by J. D. Traywick. Papers presented during Section 2 sessions were: "Design of Soil Conservation Structures", by A. A. Hakim; "Design and Fabrication of an Automatic Rotating Drum to Measure Runoff from Small Watersheds", and "Im-

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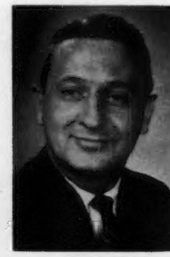
BRITISH SCIENTIST MEETS WITH AGRICULTURAL ENGINEERS

R. L. Brown, director of research, British Coal Utilization Institute, London, England, recently held a two-day conference in Kansas City, Mo., with agricultural engineers in which they discussed subjects of particle reduction, conveying and bin flow. The discussion revealed many similarities between the problems of handling coal and handling agricultural products such as grains and basic ingredients for formula feeds. Seated *(left to right)* are: D. R. Landphair, agricultural engineer, Mel Miller & Co.; R. L. Brown, and H. B. Puckett, agricultural engineer, USDA, University of Illinois; and standing *(left to right)* are H. B. Pfost, professor of flour and feed milling industries, Kansas State University; L. V. Burns, vice-president, Mel Miller & Co.; and J. H. Wessman, secretary-treasurer, Grain Processing Machinery Manufacturers Association


D. S. Weaver


E. A. Silver


W. M. Carleton


C. L. Jones


C. J. Schwartz


O. L. Symes


C. W. Doering


J. Winton


F. C. Ma


R. F. Wolfe

David S. Weaver, ASAE Fellow, has retired as director of North Carolina Agricultural Extension Service. He was born in Westwood, Ohio, in 1896, and received a B.S. degree in 1920 from Ohio State University. Following graduation, he accepted a position as instructor at Mississippi A. & M. College. In 1923 he joined the agricultural engineering staff at North Carolina State College as assistant professor, and during the years 1927 to 1936 he was successively associate professor and professor of agricultural engineering. He also received an M.S. degree in agricultural engineering from North Carolina State College in 1925. On a leave of absence during 1936 and 1937, he was appointed principal engineer for the Federal Rural Electrification Administration in Washington, D. C. This assignment came as a result of his conducting the nation's first statewide survey on rural electrification. He returned to NCS in 1938 as an extension agricultural engineer and in 1940 accepted the position of head of the agricultural engineering department. He served in this capacity until 1948 when he was made assistant director of the North Carolina Agricultural Extension Service, later becoming director.

He became an ASAE member in 1920 and was elected to the grade of Fellow in 1958. Mr. Weaver has received several awards including: The North Carolina Section of ASAE Distinguished Service Award in 1956; the USDA Superior Service Award in 1957; the North Carolina Grange Distinguished Service Award in 1955; the North Carolina Farm Bureau Distinguished Service Award in 1957; the *Progressive Farmer* Man of the Year in Service to Agriculture citation in 1957; and the *News and Observer* Tar Heel of the Week citation in 1957. He plans to continue to work with the agricultural program in North Carolina.

Edward A. Silver, research analyst for the New Holland Machine Co., has been elected executive secretary of the American Grassland Council. One of the founders of the Council, which was formed in 1944 as the Joint Committee on Grassland Farming, he has served as its vice-president for the past six years. He reports that he will assume the new responsibility in addition to his regular duties at New Holland Machine Co. Mr. Silver has been an ASAE member since 1919 and recently was elected to the grade of Fellow.

Walter M. Carleton recently has been promoted from assistant director to associate director of the Agricultural Engineering Research Division, ARS, USDA, Beltsville, Md. He joined USDA in 1956 after serving on the agricultural engineering staff at Michigan State University for more than six years.

Charles L. Jones, formerly vice-president and sales manager, Shenango Steel Buildings, Inc., has been named president of Sharon Metal Products, Inc.

Clayton J. Schwartz has been promoted to general sales manager of *Electricity on the Farm* magazine. He has been associated with the magazine since 1958, starting as midwest advertising manager in Chicago and moving to the position of eastern sales manager in New York in 1960. Previously, he had been employed in the advertising sales division of the Prairie Farmer Publication Co.

O. L. Symes has been appointed head of the agricultural engineering department at the University of Saskatchewan. He joined the University staff in 1950 as an assistant professor of agricultural engineering, and was named head of the department in 1953. He resigned this position in 1955 to become manager of the tractor and equipment sales, Overseas Division, Ford Motor Co. of Canada. He returned to the agricultural engineering department of the University of Saskatchewan in 1957 as an associate professor.

Charles W. Doering has accepted the position of chief product engineer with Brinly-Hardy Co., Louisville, Ky. He will be in charge of the designing and development of all types of new garden tractor equipment implements. He previously was located in Illinois where he served as project engineer in the Tractor-Hitch Division of International Harvester Co. at Hinsdale.

Joseph Winton and **Harold E. Brannaka** are president and vice-president, respectively, of Farm Systems, Inc., Carlisle, Pa., which has been organized recently to plan, design, sell, equip, and build complete farm systems. Both men were formerly affiliated with New Way Farm Sales, Inc. — salesman and field sales engineer, respectively.

Fengchow C. Ma, senior farm machinery specialist of Chinese-American Joint Commission on Rural Reconstruction, Taipei, Free China, has accepted a two-month mission to Liberia, where he will act as chief of a sizeable Chinese Agricultural Mission to that country. When his mission in Liberia is completed he plans to go to Vietnam to assist that country in improving its small farm implements.

Robert F. Wolfe recently has been awarded a fellowship by the National

Position Changes and New Engineering Center Announced by J. I. Case Company

Several ASAE members have assumed new duties resulting from recent position changes and the announcement of a new Wheel Tractor Engineering Center by the J. I. Case Co.

John T. Brown, vice-chairman of the board, has been assigned the responsibility for direction of the company's international division and becomes president of J. I. Case International, S.A. **Lawrence H. Hodges** has been named director of the new product planning and engineering research department. He held the position of design and research engineer at the company's Rockford, Ill., plant from 1952 to 1955, when he was promoted to chief product engineer. In 1959 he was made works manager and during that same year was promoted to director of engineering, agricultural products, at the company's headquarters in Racine, Wis.

The announcement of the new Wheel Tractor Engineering Center at the Clausen Works, that will utilize the company's Racine test area and chemical and strain gage testing equipment, also stated that **Eldon M. Brumbaugh,** manager of engineering, will have direct supervision of the center. **George M. Eveleth,** manager of engineering, Rock Island, will direct the engineering functions necessary to maintain the current tractor line, serve the engineering requirements of manufacturing, sales and service, and maintain liaison with the new center. The test area and equipment at the center includes a test track and work areas comparable to those of the University of Nebraska.

Science Foundation for study at Purdue University. Beginning in September of this year he will be working on a Ph.D. degree in agricultural engineering. He received an M.S. degree in agricultural engineering from the University of Wisconsin in January of this year and presently is employed by A. O. Smith Corp., Milwaukee, Wis.

Joseph Bornstein recently has been appointed assistant professor of agricultural engineering on a part time basis at the University of Vermont. He will teach the soil and water engineering course, which will be in addition to his duties as project supervisor of the Soil and Water Conservation Research Division cooperative drainage project of ARS, headquartered at the University of Vermont.

Charlie P. Briggs, III, employed since 1955 by the Farm Electrification Branch of AERD, ARS, USDA, resigned recently in order to assist with management of his family's cotton plantation at Calvert, Texas. He was stationed at College Station, Texas, where he conducted research on insect attractants and on responses of cotton insects to electro-magnetic radiation.

Zane C. Fairchild has accepted the position of midwest district representative for Aeroglide Corp. He will cover the territory of Nebraska, South Dakota, and the western part of Iowa. He previously was sales engineer with Notifier Engineering, Inc. of Lincoln, Nebr.

Lynn P. Johnson has accepted a position as research and development engineer with Wyatt Manufacturing Co. He formerly was a member of the agricultural engineering department staff at Montana State College.

Russell L. Perry, professor of agricultural engineering at the University of California, is on a two-year leave for a tour of duty to Indonesia. He will be working with the project which the UCLA College of Engineering is conducting to assist Gadjah Mada University at Jogjakarta, Indonesia, in the development of its College of Engineering.

A. C. Hardison, Life Member of ASAE and co-founder and president of the Limoneira Ranch, was honored recently by the University of California for "superb service to agriculture in his state and nation." Limoneira Ranch is said to be the world's largest lemon enterprise. Mr. Hardison is 92 years old and has lived in Santa Paula for 71 years.

Arthur J. Immesoete has been transferred from the John Deere Planter Works in Moline, Ill., where he was senior engineer, to John Deere Argentina, S.A.I.C. In his new position he is in charge of farm implement engineering.

Malcolm H. Kidd has been appointed a field engineer at the Springday V-Belt Plant of Dayco Corp. in Springfield, Mo. He formerly was senior V-belt engineer.

St. Clair P. Guess, Jr., manager of the service department of the National Association of Soil Conservation Districts, has been made an honorary member of the Soil Conservation Society of America. Prior to his present position with NASCD he was national program advisor for the organization.

Robert N. Adams advises that he has completed requirements for an M.S. degree in agricultural engineering at the University of Florida and has accepted a position as representative for Clewiston Motor Co., Clewiston, Fla.

William G. Crolley has been promoted from agricultural engineer with the USDA Soil Conservation Service in Liberty, Texas, to area engineer for SCS in Angleton, Texas. In his new position he will assist the Brazoria-Galveston Soil Conservation District.

Wendell E. Dorsett has accepted the position of a design engineer in the peanut combine section of Lilliston Implement Co. He formerly was a design engineer for International Harvester Co.

Horace D. Westcott has been transferred from Massey-Ferguson, Ltd., where he was a product planning field specialist, to the Fowler Division of Massey-Ferguson Inc., Fowler, Calif. His present position is that of product planning and education manager.

Eric B. Wilson is now located in Moscow, Idaho, where he is extension agricultural engineer at the University of Idaho. Formerly, he was extension agricultural engineer at Montana State College.

Myron L. Pearson has accepted the position of field representative for the Ohio College of Applied Science of Cincinnati, Ohio. He previously was associated with Quaker State Metals Co. as building products sales representative.

Donavon L. Bakker is now employed by James Mfg. Co. of Ft. Atkinson, Wis., as a research engineer. He formerly was associated with the Tractor and Implement Division of Ford Motor Co., as a design engineer.

Eugene C. Brown, Jr., has been transferred from the product engineering department of J. I. Case Co., where he was head of the tillage machinery division, to the company's office in Dallas, Texas, as territory supervisor.

USDA Soil and Water Conservation Research Division Reorganized

T. W. Edminster

Several ASAE members received new assignments in a recent reorganization of the Soil and Water Conservation Research Division, Agricultural Research Service, U.S. Department of Agriculture.

Advancements on the divisional level went to **Talcott W. Edminster,** who was appointed associate director; **Louis M. Glymph, Jr.,** who was named assistant director, watershed engineering; **Dwight D. Smith,** who was made assistant director, water management; **Ludwig L. Kelly,** who was appointed chief hydrologist; and **William A. Raney,** who was named chief soil physicist.

L. M. Glymph, Jr.

D. D. Smith

L. L. Kelly

W. A. Raney

Further advancements on the branch level involved the following personnel and their respective branches:

Northeastern Branch —

Heggie N. Holtan has been appointed to the post of director of the Hydrograph Laboratory.

Southern Branch —

Appointed as branch chief is **Russell Woodburn,** with **John C. Stephens** named as investigations leader, watershed engineering, and **John R. Carreker** as investigations leader, water management.

Cornbelt Branch —

Lloyd L. Harrold has been made superintendent of the Coshocton Hydrologic Research Station, as well as investigations leader, watershed engineering. Investigations leader for water management is now **John F. Thornton.**

Northern Plains Branch —

Aubrey L. Sharp has been appointed investigations leader, moisture conservation, and **Howard R. Haise** investigations leader for water management.

Southern Plains Branch —

William O. Ree has been appointed investigations leader for watershed engineering. **Victor I. Myers** has been named investigations leader for water management, as well as superintendent of the Weslaco Soil and Water Field Station, and **Ralph W. Baird** is superintendent of the Blacklands Experimental Watershed.

Northwestern Branch —

Appointed to the position of investigations leader, water management, is **Marvin E. Jensen,** and the position of investigations leader for erosion is now held by **Stephen J. Mech.**

Southwestern Branch —

William W. Donnan has been appointed branch chief, while **Lloyd E. Myers** is continuing as director of the Water Conservation Laboratory. Appointed to the position of investigations leader for watershed engineering is **Robert B. Hickok,** and **Dean C. Muckel** to the position of investigations leader for seepage.

Ohio Section

The Ohio Section has elected the following officers for the year 1961-62: R. V. Morr, chairman; R. E. Fast, vice-chairman; and R. A. Miller, secretary-treasurer. The following nominating committee was also appointed: K. A. Harkness, J. R. Beebe, and J. A. Higginbotham, Jr.

Kentucky Section

The Kentucky Section has elected the following officers for the year 1961-62: H. N. Luebeke, chairman; K. C. Mills, program vice-chairman; J. M. Burns, publicity vice-chairman; C. O. Shults, membership vice-chairman; and G. H. Jenkins, Jr., secretary-treasurer.

Quad City Section

The Quad City Section has scheduled the following meetings for the forthcoming year: November 17, January 12, March 2 and the annual meeting on May 4 at the Hotel Blackhawk, Davenport, Iowa. A series of three technical sessions are also scheduled for January 18, January 25 and February 1.

South Carolina Section

The summer meeting of the South Carolina Section will be held at Cherry Grove Beach, S. C., on August 25, 26 and 27.

The Hawaii Section has extended an invitation to any ASAE member, as a guest or luncheon speaker, to attend its second Coordinating Conference, which will be held September 28 and 29 on the island of Maui. Anyone planning to be in Hawaii should contact C. B. Holtwick, secretary-treasurer, Hawaii Section, at the following address: Hawaii Sugar Planters Association Experimental Station, 1527 Keeaumoku St., Honolulu 14, Hawaii.

Michigan Section

The Executive Committee of the Michigan Section held a meeting on June 16 at which the date of the Section's fall meeting was set. This meeting will be held October 28 at Michigan State University. The following committees were appointed: Program — B. J. Lamp (chairman), D. J. Campbell, E. H. Kidder, G. W. Schenk, and T. J. Reed; Membership and Attendance — R. W. Wilson (chairman), D. H. Schairer, W. A. Wathen, and B. A. Stout; Publicity — F. H. Buelow (chairman), C. F. Albrecht, G. K. McCutcheon, and J. C. Cahill; Boosters (Subcommittee of Membership and Attendance Committee) — R. W. Wilson (chairman), M. L. Bailey, C. T. Morton, A. K. Mortin, R. L. Coriell, J. R. Young, R. J. Alpers, and Ira Maxon.

Pacific Coast Section

The following officers have been announced to serve the Pacific Coast Section's three Chapters for 1961-62:

Northern California Chapter — W. O. Pruitt, Jr., chairman; W. N. King, vice-chairman; and W. C. Fairbank, secretary-treasurer.

Southern California Chapter—W. A. Hall, chairman; A. F. Klinge, vice-chairman; and H. W. Weskamp, secretary-treasurer.

Arizona Chapter — R. E. Moore, chairman; C. D. Owens, vice-chairman; and L. F. Riggins, secretary-treasurer.

W. J. Adams, Jr., section chairman, has also announced the appointment of the following committee chairmen to serve the section during 1961-62: Program — K. W. Koenig; Arrangements — F. H. Coover; Membership and Promotion — W. N. King; Publicity — E. H. Weiner; Finance — J. R. Turner; Student Activities — T. E. Wales, Jr.; Vocation and Training — N. B. Akesson; Professional Registration — J. L. Merriam; Newsletter — R. B. Fridley; and Industrial and Government Contacts — D. A. Murray.

EVENTS CALENDAR

August 28 - September 1 — *ASME International Heat Transfer Conference,* University of Colorado, Boulder. Write to American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y., for information.

September 4-10 — *International Commission of Agricultural Engineering (CIGR), First and Second Sections Work Meetings,* Rome and Sardinia, Italy. Write to CIGR, Paris, France, for details.

In one of those unexplainable situations where the subjects were inadvertently misassociated with their proper Section, the caption accompanying the above photograph was in error in the July issue. The officers shown should have been identified with the Mid-Central Section rather than the Central Illinois Section. The proper caption is as follows: ASAE President L. W. Hurlbut poses with Mid-Central Section officers. From left to right are *(seated)* C. W. Bockhop, past-chairman; Hurlbut; T. O. Hodges, chairman; D. B. Brooker, vice-chairman; and *(standing)* R. A. Saul, vice-chairman; Howard Johnson, secretary-treasurer; and J. C. Steele, vice-chairman. Picture was taken during the Mid-Central Section meeting April 7 and 8 at the Hotel Robidoux in St. Joseph, Mo.

ASAE MEETINGS CALENDAR

August 20-23—North Atlantic Section, University of New Brunswick, Fredericton, N. B., Canada.

August 25-27—South Carolina Section, Cherry Grove Beach, S. C.

August 28 — Baton Rouge Section, Agricultural Engineering Auditorium, Louisiana State University, Baton Rouge.

September 28-29 — Hawaii Section, Coordinating Conference, island of Maui.

October 6 and 7 — Ohio Section, Ohio State University, Columbus, Ohio.

October 18-20 — Pacific Northwest Section, Boise Hotel, Boise, Idaho.

October 20-21 — Pennsylvania Section, Pennsylvania State University, University Park.

October 28—Michigan Section, Michigan State University, East Lansing.

November 17—Quad City Section (place to be announced later).

December 12-15 — Winter Meeting, Palmer House, Chicago, Ill.

June 17-20 — Annual Meeting, Mayflower Hotel, Washington, D. C.

Note: Information on the above meetings, including copies of programs, etc., will be sent on request to ASAE, St. Joseph, Mich.

September 5 - 8 — *11th National Chemical Exposition,* sponsored by the Chicago Section, American Chemical Society, International Amphitheatre, Chicago, Ill. Further information may be obtained from The Chicago Section of the American Chemical Society, 86 E. Randolph St., Chicago 1, Ill.

September 6-8 — *Seventh Midwest Conference of Fluid Mechanics and Solid Mechanics,* Kellogg Center for Continuing Education, Michigan State University, East Lansing. Address inquiries concerning the conference to: Conference Publicity Committee, c/o J. E. Lay, Department of Mechanical Engineering, MSU, East Lansing, Mich.

September 9-24 — *42nd National Fair,* Comptoir Suisse, Lausanne, Switzerland. Obtain information from the Fair Administrative Offices, Comptoir Suisse, Palais de Beaulieu, Lausanne, Switzerland.

September 10-13 — *68th Annual Farm Equipment Institute Convention,* Palmer House, Chicago, Ill. For details contact FEI, 608 S. Dearborn St., Chicago 5, Ill.

September 11-14 — *SAE "Heavy-Duty" Vehicle Meeting,* Milwaukee Auditorium, Milwaukee, Wis. Obtain further information from Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

September 11-22—*Institute in Experimental Stress Analysis,* Engineering Mechanics Dept., Wayne State University. For information write to Joseph Der Hovanesian, Institute Coordinator, Department of Engineering Mechanics, Wayne State University, 655 Merrick, Detroit 2, Mich.

September 15-16—*National Plowing Matches for 1961,* Melrose, Minn. For further information write to Eugene Holmes, Waldorf, Minn.

September 24-26 — *International Congress of Automation,* Turin, Italy. For details, write to the Associazione Nazionale per L'Automazione, Plazza Belgioioso 1, Milano, Italy.

September 25-28 — *The American Welding Society Fall Meeting,* Adolphus Hotel,

(Continued on page 454)

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. . . News

(Continued from page 435)

portance of Tractive Force Theory in Soil Conservation", by K. S. Yadav; and "Sprinkler Irrigation Types and Possibilities", by B. K. Bhattacharjee and E. H. Davis. In a joint session the following papers were included: "The Contribution Agricultural Engineers Can Make to Indian Economy", by Mason Vaugh; "Need of Agricultural Engineers in India", by R. C. Hay; "Scope of Agricultural Engineering in India Today", by A. A. Hakim; "Extension Approach in Agricultural Engineering", by D. N. Kherdekar; and "Agricultural Engineering Education in India", by S. V. Arya. Research Summaries from the 1960 Agricultural Engineering Symposium, in the form of a 40-page booklet, is available from the Agricultural Engineering Department, Indian Institute of Technology, Kharagpur, India.

Annual Meeting Award Winners

Due to the shortage of space in the July issue the Annual Meeting Award Winners other than the Gold Medalists and Student Honor Awards were not carried. Following are Journal Paper Awards and Blue Ribbon Awards.

Journal Paper Awards

Following are the top ten papers published in AGRICULTURAL ENGINEERING during 1960, as judged by the Committee on Journal Paper Awards — T. O. Hodges (chairman), Howard Matson (vice-chairman), G. W. Isaacs, N. H. Curry, and G. W. Steinbruegge. The ASAE members who were authors of the five winning papers will receive a certificate and a one-year's paid-up membership in the Society. Non-member authors of winning papers will receive a certificate and "Honorable Mention" status. The five winning papers in order of highest scoring are: "Similitude in Studies of Tillage Implement Forces, by K. K. Barnes, C. W. Bockhop, and H. E. McLeod (January); "Agricultural Applications of the Dual-Monochromator Spectrophotometer," by G. S. Birth (July); "Relations Between Air and Solid Particles Moving Upward in a Vertical Pipe," by W. J. Chancellor (March); "Functional and Basic Requirements of Swine Housing," by T. E. Hazen and D. W. Mangold (September); and "Physical Environment and Confinement Housing of Dairy Cows," by R. E. Stewart (September).

Authors of papers in the following group also were awarded "Honorable Mention" status: "Tile Flow Measured Electrically," by R. H. Hahn and G. O. Schwab (December); "Canopy Inlet for Closed Conduits," by R. P. Beasley, L. D. Meyer, and E. T. Smerdon (April); "Emergence Energy of Plant Seedlings," by C. T. Morton and W. F. Buchele (July); "Improved Procedures in Grassed Waterway Design," by C. L. Larson and D. M. Manbeck (October); and "Two-Stage Reservoir Inlets," by M. M. Culp (August).

Blue Ribbon Awards for Annual Meeting Exhibits

Public service and industrial organizations from all parts of the country displayed exhibits at the 1961 Annual ASAE Meeting with classifications including: Publications; radio and television; motion pictures; and demonstration models.

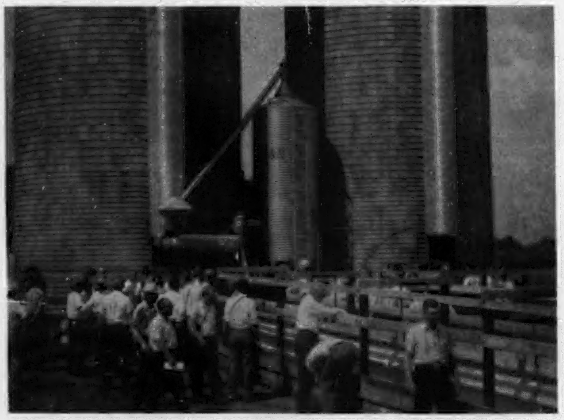
Under "Bulletins" in the Public Agency class the winners were: "Electric Heating Cable for Swine," by A. J. Muehling and E. L. Hansen, University of Illinois; "Selecting and Installing Dairy Stable Ventilation," by J. A. McCurdy, Pennsylvania Agricultural Extension Service; and "Weed Seed Screens for Irrigation Systems," by Walter Bergstrom, Extension Service for Oregon, Idaho, and Washington. For "Bulletins" in the Industrial class were the following winners: "Modern Improvements for Top Pork Production," by M. L. Burgener, Portland Cement Association; and "Soil Insect Control in Corn," by K. V. Fiske, Velsicol Chemical Corp. The winners in the Public Agency group under "Circulars" were: "Four Big Steps to Quality Hay," by W. E. Gill and W. R. Schnug, Ohio Agricultural Extension Service and Ohio Farm Electrification Council; and "Make Your Water Supply," by N. H. Wooding, Jr., Pennsylvania Agricultural Extension Service. In the Industrial group under "Circulars" the winner was: "Hog Producers — Here's a Plan for Higher Profit," by M. L. Burgener, Portland Cement Association. In the "Periodical" section under Industrial the winner was: "Rural Concrete Builder No. 18," by M. L. Burgener, Portland Cement Association. In the Public Agency group under the "Manuals" category the winners were: "More Power to You 4-H, 134," by A. V. Krewatch, University of Maryland; and "Your 4-H Electric Program — Workbook No. 2," by K. L. McFate, University of Missouri. Under "Manuals" in the Industrial section W. L. Griebeler, Douglas Fir Plywood Association, won with "Farm Construction Guide."

The winner in the Industrial group under "Radio" was "Progress in Farm Building," Portland Cement Association, and in the Public Agency group the winner was "Electricity at Work," Michigan State University. Under "TV," "Electricity at Work," Michigan State University was the winner in the Public Agency group, and "Hogs from Birth to Market," Portland Cement Association, in the Industrial group.

Winners of the "Motion Picture" awards in the Public Agency class were "Soil Insect Control in Corn," Iowa State University, and Velsicol Chemical Corp., and "Peach Handling," Michigan State University. In the

(Continued on page 454)

ASAE ANNUAL MEETING TOURS AND EXHIBIT VIEWS



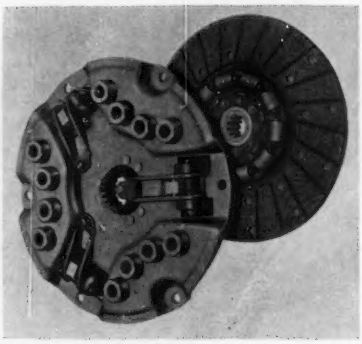
(Above) **Three busloads of ASAE members inspect mechanized beef feeding lot installation near Minburn, Iowa, on field trip during 54th Annual ASAE Meeting held in Ames, in June.**

Iowa State University students show keen interest in an exhibit on measuring radiation prepared by the Agricultural Engineering Research Division, ARS, U.S. Department of Agriculture

(Right) **ASAE members were permitted to tour the facilities of the National Animal Disease Laboratory recently opened by the U.S. Department of Agriculture at Ames. Shown is a research team at work in one of 32 isolated laboratory units**

New High-Speed Clutches

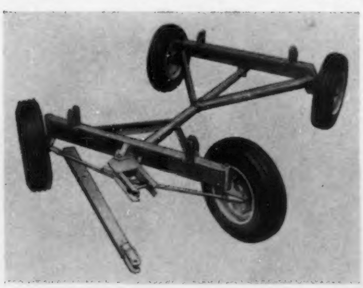
Rockford Clutch Division, Borg-Warner Corp., Rockford, Ill., has announced new dual-drive, spring-loaded clutches designed



to meet high-speed engine requirements. Designated as model FA, the new clutches use a counterbalanced release lever which permits high-speed operation, without increasing release pressure at low pedal pressure. Provision is made for a built-in live PTO which runs constantly from flywheel through a splined hollow shaft. Through a choice of engagement springs and friction materials, the new clutches are available in a wide range of torque capacities.

Adds Wagons to Line

Electric Wheel Co., a division of the Firestone Tire & Rubber Co., Quincy 79, Ill., has introduced a new line of wagons



featuring an improved short-turn design and large capacities. Included in the new line are three auto-steer models with capacities of 4, 5, and 6½-ton gross load and one 5th-wheel model with a 5-ton capacity. All four models have a new rear-axle arrangement which is a single piece of steel formed into a closed-box section and shaped to receive spindles. Wagon boxes include flare and barge boxes with capacities from 110 to 150 bu.

New Nickel Alloy Steel

The International Nickel Co., Inc., 67 Wall St., New York 5, N. Y., has developed a new 18 percent nickel alloy steel said to open the way for a new family of high-strength steels with advanced engineering design possibilities involving exceptionally high pressure and stress. According to the manufacturer, it has the ability to achieve a yield strength in excess of 250,000 psi while maintaining a nil ductility temperature below −80 F, and has a notched tensile strength which exceeds 400,000 psi. Company tests have shown that this new alloy possesses a remarkable resistance to delayed cracking when exposed to a severe corrosive atmosphere in a highly stressed condition.

The new steel reportedly develops its high strength while maintaining ductility and toughness by means of a heat treatment involving age-hardening of martensite and called "mar-aging." The new steel has a nominal composition of 18 percent nickel, 7 percent cobalt, 5 percent molybdenum and less than 0.5 percent titanium with a maximum of 0.05 percent carbon. Higher and lower tensile strength can be obtained by modification of this basic composition.

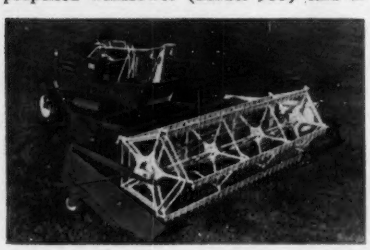
Compact Harvestore

A. O. Smith Harvestore Products, Inc., Kankakee, Ill., has gone compact with its new small-sized glass-lined "Harvestore"

grain storage unit that stores and feeds high moisture corn, or stores dry shelled corn. The new unit (constructed in the same manner as the large versions) provides breather bag system for sealed storage, glass-fused-to-steel inside and out, and choice of two bottom unloaders. By adding either a standard grain auger bottom unloader or a new sweep arm auger bottom unloader the new model can be used for storing, processing and feeding high moisture grain to beef cattle, dairy cattle and hogs. The new small-sized grain storage units come in two sizes: 14 ft by 20 ft with a 2,450-bu capacity and a 20 ft by 20 ft with 4,700-bu capacity. For additional information contact the company.

Self-Propelled Windrower

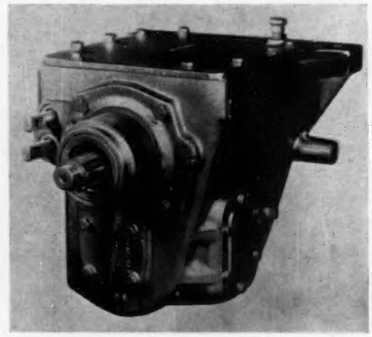
New Holland Machine Co., New Holland, Pa., has announced a new self-propelled windrower (Model 900) said to



be capable of handling 80 acres of hay a day. The new machine mows, conditions and windrows at the same time in a swath up to 16 ft wide. A special system automatically adjusts platform angle as the header is raised. Cutting heights range from 1½ to 29 in. In raised position, the angle adjusts for grain at 10 deg. In down position, the angle adjusts for hay at 23 deg.

New Auxiliary Transmission

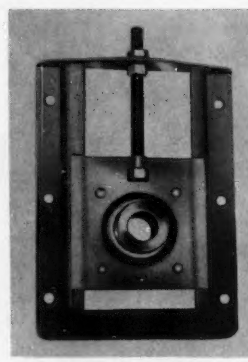
Dana Corp., Toledo 1, Ohio, has introduced a new four-speed model 7041 auxiliary transmission with nominal torque rating



of 550 to 600 ft-lb. Constant mesh helical gears are used throughout. The unit weighs 340 lb with an overall length of $25\frac{3}{16}$ in. It is designed for use with standard four or five-speed transmissions in the 400 to 600 ft-lb capacity range. A top-mount PTO, developed specifically for this unit, is available.

Take-Up Bearing Unit

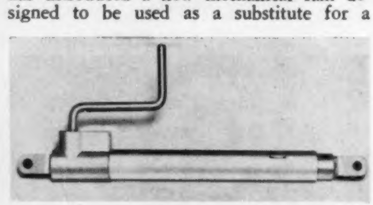
Roberts Mfg., Inc., 1002 W. Elm St., Salina, Kans., has announced a new light-duty, take-up bearing unit, available either



with or without frames. Units incorporate stamped bearings, which are prelubricated at assembly. Laminated neoprene felt seals are used in the bearings, sealing grease in and dirt and foreign matter out. Bearings are available in shaft sizes from ⅝ in. through 1 in.

Ram Subs for Hydraulic System

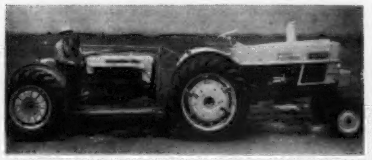
Hammer Blow Tool Co., Wausau, Wis., has introduced a new mechanical ram designed to be used as a substitute for a



hydraulic cylinder where hydraulic power is now available, or to be used as a replacement in the event of hydraulic failure. Interchangeable with standard hydraulic facilities it is designed and manufactured to the same specifications, with a retracted length of 20¼ in., an extended length of 28¼ in., and an 8-in. stroke. The clearances between the clevis forks are 1⅛ in., and made to be used with 1-in. clevis pins.

Tandem Tractor Conversion

Tractor and Implement Division, Ford Motor Co., Birmingham, Mich., has announced a two-tractor tandem combination

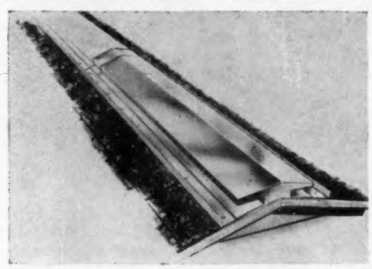


which is said to develop approximately 100-110 hp and pulls a 7-bottom 16-in. plow or an 8-bottom 14-in. plow. A new power shift transmission reportedly simplifies the operating controls and the attaching devices for the two tractors, thereby requiring only a relatively simple attaching kit to convert the regular tractors into a four-wheel drive machine. According to the manufacturer, conversion can be made in less than two hours, and once attachments are fitted to the rear tractor, the front unit can be linked in tandem and be ready for operation by one man in less than 30 min.

The attaching kit consists of a pull bar, linking both tractors together and supporting the front end of the rear tractor. Drawbar implements are attached to this pull bar for field work. The kit provides steering linkage which enables the operator to sit on the rear tractor and steer through the front tractor's front wheels. The kit also provides cable linkage and control handles to enable the operator to select the transmission gears desired and to regulate the throttle setting of the front tractor, and supplementary foot pedals for remote braking of the front tractor.

Develops Vented Ridge

Home Comfort Products Co., Princeville, Ill., has developed a continuous ridge ventilator for providing free escape for warm



and humid air the full length of building. In installation it is necessary to open a gap in the ridge 1½ in. wide and cover with the new product. The manufacturer reports that 18 ft of vented ridge has the capacity of a 20-in. stack vent.

Mortar Adhesion Additive

The Dow Chemical Co., Midland, Mich., has developed a new product called Styrocrete, a special latex additive for Portland Cement mortar for use in bonding Styrofoam insulation boards to masonry, cured concrete, metal, or other surfaces. Synthetic latex particles in the new product are said to greatly increase mortar adhesion, reduce water and water vapor transmission through the mortar, and result in over-all stronger and tougher mortars.

New Plant Growth Lamp

Sylvania Electric Products Inc., 730 Third Ave., New York 17, N. Y., has announced the development of a fluorescent lamp designed to improve certain growth aspects of

(Continued on page 444)

. . . New Products

(Continued from page 443)

plants through specific spectral energy distribution. According to reports the lamp makes it possible to obtain in one tube a balance of radiation, and it provides peaks of energy in the blue and red regions of the spectrum considered to be the most desirable for improved vegetative growth.

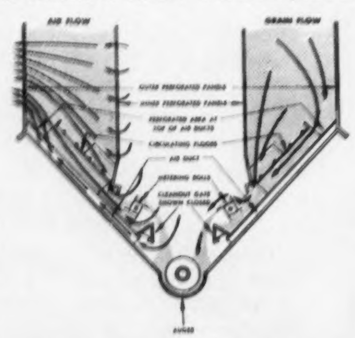
Forage Box with Built-in Flare

New Holland Machine Co., New Holland, Pa., has introduced its new Model 475 forage box with a built-in flare. The

new flare (in construction of the upper sides of the box) increases capacity and provides a wide target area for directing forage from a forage harvester. With the flared top, box capacity is given at 247 bu. With forage sides removed the new model converts into an ASAE-rated 175-bu power spreader. An optional third beater is available to increase unloading speed in grass or corn silage and to aid in mixing concentrate with the feed.

New Portable Drier

Lennox Industries Inc., 1701 E. Euclid Ave., Des Moines 5, Iowa, has announced the addition of the new model BB4, 230-bu



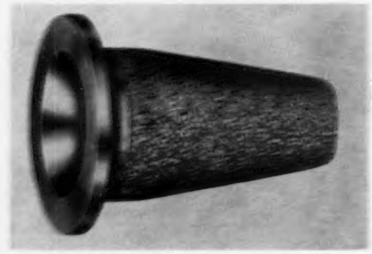
portable grain drier to its line. The new model features metering rolls to regulate the flow of grain for circulation with an adjustable ratchet drive on the metering rolls to control the speed of grain movement. Also, air ducts have circulating floors. A modulating gas valve is used to maintain constant temperature.

Self-Sharpening Sickle

American Specialty Co., 4905 N. Main St., Stratford, Conn., has introduced a new self-sharpening armored sickle section with a tungsten carbide cutting edge. In manufacture a new process fuses a thin layer of the hard tungsten carbide to the underside of a sickle section made from a tough alloy steel. The tungsten carbide on the underside of the section develops a self-sharpening action. As the alloy wears away slowly it continuously exposes the carbide underneath, thereby lengthening tool life and maintaining a sharp edge.

New Strainer for Low Capacity Spraying

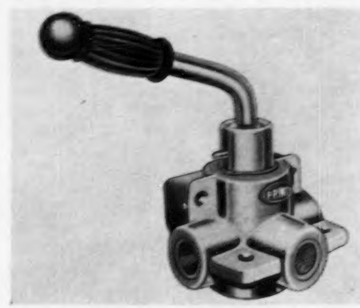
Spraying Systems Co., 3226 Randolph St., Bellwood, Ill., has introduced a new strainer designed to act in the range of a filter for



farm spraying applied at unusually low volume per acre where a small orifice opening of as little as 0.016 in. equivalent diameter is required. The new strainer is said to have a filtering action equivalent to that of a 300-mesh screen. For information write to the company for Data Sheet 9280.

Cultivator Selector Valve

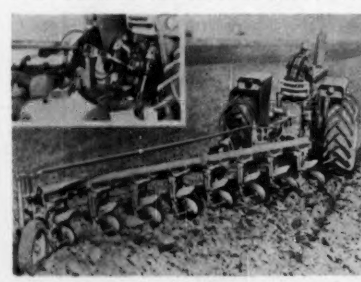
Prince Manufacturing Corp., Sioux City, Iowa, has announced its PM-V-2, three-way hydraulic selector valve for use with front-



mounted cultivators operating off a hydraulically operated rock shaft. The valve permits three-position control of the gangs—lowering and raising either side individually, or both together.

New Plow Design

Oliver Corp., 400 W. Madison St., Chicago 6, Ill., has developed a new series of 4 to 8-bottom semi-mounted plows with



new pivoting hitch and plow-lift controls. The new plows are especially coordinated to the company's new 1800 and 1900 gas and diesel tractors with lower link draft sensing 3-point hitch but will fit most makes of tractors with 3-point hitches. According to the company, the design of the new plows provides weight transfer and traction advantages of a mounted plow and the tractor riding comfort of a trailed plow. The hitch reportedly transfers much plow and soil weight to the rear wheels of the

tractor while the rear plow wheel also carries weight to increase stability.

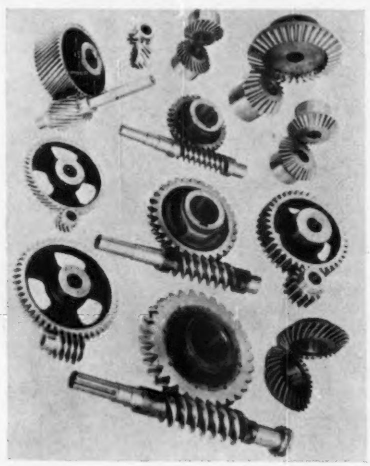
The new semi-mounted plow series includes a new 8 or 7-bottom, 16-in. model 5760 and a new model 5540 series of 4, 5, and 6-bottom plows, 14 or 16 in., all with the pivoting hitch. For plow transport, lower draft links of the tractor lift the plow's front end. An external hydraulic cylinder actuates parallel linkage to the tail wheel to lift the rear end.

Adds Sintered Products

Russell, Burdsall & Ward Bolt and Nut Co., 100 Midland Ave., Port Chester, N. Y., has announced establishment of a sintered products division for the manufacture of powder metal parts. Typical parts to be produced from powder metals include standard nuts, special nuts and shapes with tapped holes, sleeves, spacers, inserts, disks, gears, rollers, electrical connectors, mechanisms and bushings. It is reported that sintered parts will be produced from brass, bronze, copper, Monel and nickel silver among non-ferrous metals, as well as iron, steel and stainless steel.

New Stock Gear Line

Morse Chain Co., Ithaca, N. Y., is offering a line of stock gears available for off-the-shelf delivery. Although the new line



will be 20-deg pressure angle gears, the company reports that a set will be interchangeable with a 14½-deg set. Single gears, however, are not interchangeable. Present plans call for gears in the 3 to 20 pitch range. Types to be produced are spur, bevel, miter sets (both straight and spiral), helical and worm and gear sets. High-carbon steel, alloy cast iron, nickel bronze (worm gears) will be used. Non-metallic spur gears will be offered for low-load, high-speed applications.

New Grain Storage Aids

Radson Engineering Corp., Macon, Ill., has introduced a new grain temperature measuring system and a grain sampling probe. The new temperature measuring device is comprised of *(a)* temperature cables with sensing tips inserted into grain and left there; *(b)* weatherproof connector boxes for mounting outside of bin, and *(c)* grain temperature meter. Temperature of grain can be read instantaneously by merely plugging the grain temperature meter into the connector. The system can be installed in any size bin, grainery, flat storage building or in grain piled outside. Several sensing units can be placed in the same storage facility where temperatures are needed from different locations. Key element in the system is a tiny thermistor buried in the sensing tip. Lead wires can be any length — comes equipped with 25 ft of wire. No outside power source is needed. Another use for the system is in bin drying units where heat can be checked to locate the drying zone and assure proper operation of drier.

The new sampling probe, designed to spot-sample grain in storage or in bin drying set ups, consists of a pointed aluminum chamber which may be screwed on the end of multiple inserting sections. Chamber is inserted into grain and opens automatically, taking sample the instant probe starts to be withdrawn, for use in a moisture meter. Probe chamber may be used with ¼-in. pipe for inserting into grain.

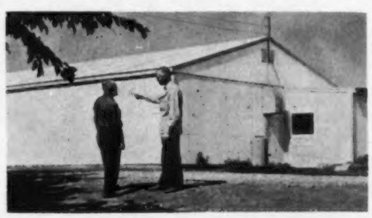
Increases Universal Joint Range

Neapco Products, Inc., Engineering Dept., Pottstown, Pa., announces a new series of universal joints and drives with the fol-

lowing ratings: 55 hp at 550 rpm; torque, 10,000 in.-lb; maximum operating angularity, 45 deg; and maximum static angularity, 90 deg. End yokes include clamp and quick disconnect types for tractors plus standard, square, heavy and long types. All yokes are available in a wide range of bore sizes. Drive lines include telescoping and safety shielded assemblies. Telescoping assemblies are round type and sleeve type construction with maximum extended length of 90 in., minimum compressed length 14½ in. Shielded assemblies available in either telescoping or fixed lengths.

Windowless Poultry Houses

Masonite Corp., Farm Service Bureau, Suite 2037, 111 W. Washington St., Chicago 2, Ill., has announced availability of windowless poultry houses in widths up to 40 ft



and any length. According to the manufacturer, the absence of windows increases uniformity in control of temperature, ventilation, and lighting. Pre-painted hardboard panels are used in insulated, glued and nailed sections to build the poultry house on the site in a few days.

New Engine Cooling System

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. . . New Products

(Continued from page 443)

plants through specific spectral energy distribution. According to reports the lamp makes it possible to obtain in one tube a balance of radiation, and it provides peaks of energy in the blue and red regions of the spectrum considered to be the most desirable for improved vegetative growth.

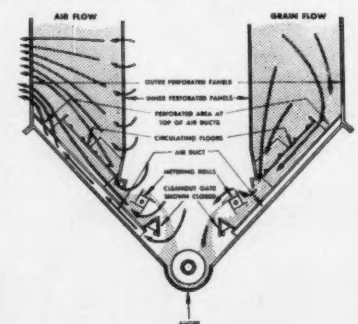
Forage Box with Built-in Flare

New Holland Machine Co., New Holland, Pa., has introduced its new Model 475 forage box with a built-in flare. The

new flare (in construction of the upper sides of the box) increases capacity and provides a wide target area for directing forage from a forage harvester. With the flared top, box capacity is given at 247 bu. With forage sides removed the new model converts into an ASAE-rated 175-bu power spreader. An optional third beater is available to increase unloading speed in grass or corn silage and to aid in mixing concentrate with the feed.

New Portable Drier

Lennox Industries Inc., 1701 E. Euclid Ave., Des Moines 5, Iowa, has announced the addition of the new model BB4, 230-bu



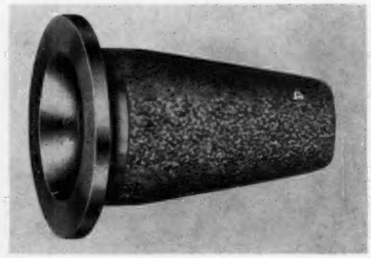
portable grain drier to its line. The new model features metering rolls to regulate the flow of grain for circulation with an adjustable ratchet drive on the metering rolls to control the speed of grain movement. Also, air ducts have circulating floors. A modulating gas valve is used to maintain constant temperature.

Self-Sharpening Sickle

American Specialty Co., 4905 N. Main St., Stratford, Conn., has introduced a new self-sharpening armored sickle section with a tungsten carbide cutting edge. In manufacture a new process fuses a thin layer of the hard tungsten carbide to the underside of a sickle section made from a tough alloy steel. The tungsten carbide on the underside of the section develops a self-sharpening action. As the alloy wears away slowly it continuously exposes the carbide underneath, thereby lengthening tool life and maintaining a sharp edge.

New Strainer for Low Capacity Spraying

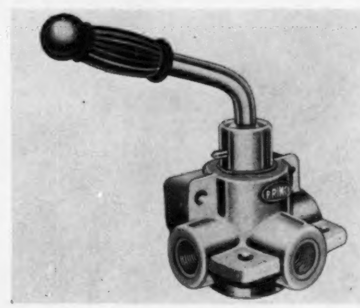
Spraying Systems Co., 3226 Randolph St., Bellwood, Ill., has introduced a new strainer designed to act in the range of a filter for



farm spraying applied at unusually low volume per acre where a small orifice opening of as little as 0.016 in. equivalent diameter is required. The new strainer is said to have a filtering action equivalent to that of a 300-mesh screen. For information write to the company for Data Sheet 9280.

Cultivator Selector Valve

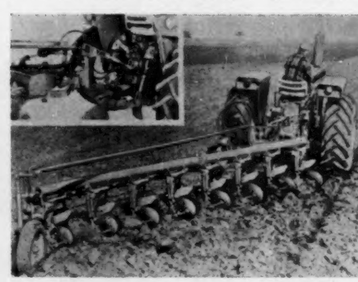
Prince Manufacturing Corp., Sioux City, Iowa, has announced its PM-V-2, three-way hydraulic selector valve for use with front-



mounted cultivators operating off a hydraulically operated rock shaft. The valve permits three-position control of the gangs—lowering and raising either side individually, or both together.

New Plow Design

Oliver Corp., 400 W. Madison St., Chicago 6, Ill., has developed a new series of 4 to 8-bottom semi-mounted plows with



new pivoting hitch and plow-lift controls. The new plows are especially coordinated to the company's new 1800 and 1900 gas and diesel tractors with lower link draft sensing 3-point hitch but will fit most makes of tractors with 3-point hitches. According to the company, the design of the new plows provides weight transfer and traction advantages of a mounted plow and the tractor riding comfort of a trailed plow. The hitch reportedly transfers much plow and soil weight to the rear wheels of the

tractor while the rear plow wheel also carries weight to increase stability.

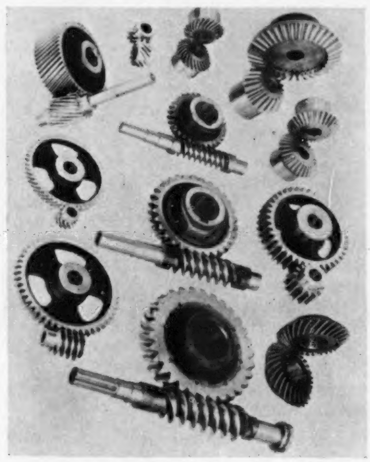
The new semi-mounted plow series includes a new 8 or 7-bottom, 16-in. model 5760 and a new model 5540 series of 4, 5, and 6-bottom plows, 14 or 16 in., all with the pivoting hitch. For plow transport, lower draft links of the tractor lift the plow's front end. An external hydraulic cylinder actuates parallel linkage to the tail wheel to lift the rear end.

Adds Sintered Products

Russell, Burdsall & Ward Bolt and Nut Co., 100 Midland Ave., Port Chester, N. Y., has announced establishment of a sintered products division for the manufacture of powder metal parts. Typical parts to be produced from powder metals include standard nuts, special nuts and shapes with tapped holes, sleeves, spacers, inserts, disks, gears, rollers, electrical connectors, mechanisms and bushings. It is reported that sintered parts will be produced from brass, bronze, copper, Monel and nickel silver among non-ferrous metals, as well as iron, steel and stainless steel.

New Stock Gear Line

Morse Chain Co., Ithaca, N. Y., is offering a line of stock gears available for off-the-shelf delivery. Although the new line



will be 20-deg pressure angle gears, the company reports that a set will be interchangeable with a 14½-deg set. Single gears, however, are not interchangeable. Present plans call for gears in the 3 to 20 pitch range. Types to be produced are spur, bevel, miter sets (both straight and spiral), helical and worm and gear sets. High-carbon steel, alloy cast iron, nickel bronze (worm gears) will be used. Non-metallic spur gears will be offered for low-load, high-speed applications.

New Grain Storage Aids

Radson Engineering Corp., Macon, Ill., has introduced a new grain temperature measuring system and a grain sampling probe. The new temperature measuring device is comprised of *(a)* temperature cables with sensing tips inserted into grain and left there; *(b)* weatherproof connector boxes for mounting outside of bin, and *(c)* grain temperature meter. Temperature of grain can be read instantaneously by merely plugging the grain temperature meter into the connector. The system can be installed in any size bin, grainery, flat storage building or in grain piled outside. Several sensing units can be placed in the same storage facility where temperatures are needed from different locations. Key element in the system is a tiny thermistor buried in the sensing tip. Lead wires can be any length — comes equipped with 25 ft of wire. No outside power source is needed. Another use for the system is in bin drying units where heat can be checked to locate the drying zone and assure proper operation of drier.

The new sampling probe, designed to spot-sample grain in storage or in bin drying set ups, consists of a pointed aluminum chamber which may be screwed on the end of multiple inserting sections. Chamber is inserted into grain and opens automatically, taking sample the instant probe starts to be withdrawn, for use in a moisture meter. Probe chamber may be used with ¼-in. pipe for inserting into grain.

Increases Universal Joint Range

Neapco Products, Inc., Engineering Dept., Pottstown, Pa., announces a new series of universal joints and drives with the fol-

lowing ratings: 55 hp at 550 rpm; torque, 10,000 in.-lb; maximum operating angularity, 45 deg; and maximum static angularity, 90 deg. End yokes include clamp and quick disconnect types for tractors plus standard, square, heavy and long types. All yokes are available in a wide range of bore sizes. Drive lines include telescoping and safety shielded assemblies. Telescoping assemblies are round type and sleeve type construction with maximum extended length of 90 in., minimum compressed length 14½ in. Shielded assemblies available in either telescoping or fixed lengths.

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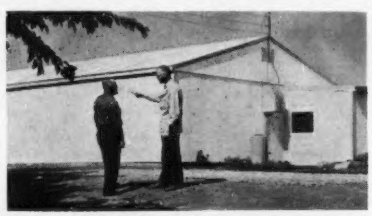

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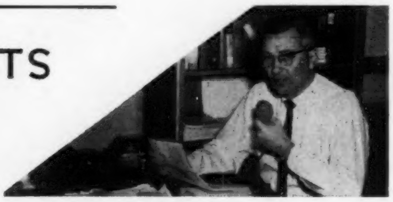
CHECK POINTS

by J. L. BUTT



HOW ABOUT *YOUR* FUTURE?

NOTHING is more important to the continuing development and advancement of an individual than being able, current and well-informed in his specialty field.

Consider for a moment the value *you* place on those who keep up to date. Suppose, for some illness which you might incur, that you had to choose between two doctors. One of the two, you learn, regularly attends medical association meetings, special short courses describing new techniques, and special conferences relating to his work. You also notice that he proudly displays the symbols of his profession — association membership certificates, the various medical symbols, the journals and literature pertaining to his profession (obviously well used). Suppose this doctor also indicated his interest in community and fellowman by active participation in civic activities, school boards, church work and humanitarian projects and activities.

In contrast, let us suppose that the other doctor displayed none of these symbols of the professional man. Perhaps his interests were more personal, his continuing contact with his profession almost nil, his education obviously limited to the knowledge he accumulated during his formal training. Which of the two doctors would you select?

The value of continuing education today is much greater than it has ever been in the history of mankind. In a recent address by an Assistant Secretary of Defense, we noted the following statements:

"... if your dad were 20 or 30 or 40 years behind the times, it didn't matter much because the times weren't moving much in those days. Now, in these times, things are exploding! If you are 20 or 30 months behind the times, you are further behind than your dad was when he was 20 or 30 years behind."

We doubt that agricultural engineering technology is exploding at quite this rate, but it doesn't miss it very far. The agricultural engineer who wants to assure his future progress and development *must* stay up to date in the technological advances of his profession or submit to a career of mediocrity.

I once heard an administrator say, in essence: "This man was once one of our best staff workers who showed tremendous potential for advancement, but he seemed to lose interest in his professional development. And I will be glad to see him retire a couple of years hence so I can replace him with a new, enthusiastic individual." Thank goodness, the person to whom he was referring was not an agricultural engineer.

The point we want to make is that *every* agricultural engineer should see that his education does not terminate upon graduation from college. Who was it that said "when a man loses the desire to learn, he is already dead"? How, then, can an agricultural engineer continue his education after graduation?

There are, of course, many ways. Colleges and universities offer short courses, refresher courses, advanced degrees, and night schools. Opportunities are available for individuals to take special courses in such things as political action, public speaking, and economics. There is always the opportunity for continued study through textbooks, magazines, and the offerings of the local library.

Most important of all, in our opinion, is the opportunity available to *every* agricultural engineer, regardless of location, to continue his education by affiliation with his professional society. What does his professional society, ASAE, offer the agricultural engineer?

Perhaps the most obvious service is the literature of the profession: AGRICULTURAL ENGINEERING, AGRICULTURAL ENGINEERS YEARBOOK, TRANSACTIONS OF THE ASAE, technical papers, special publications and committee reports, and the newly authorized monograph series. Are you fully aware of all the services provided by your Journal? Let's review the following list to see how many you use regularly.

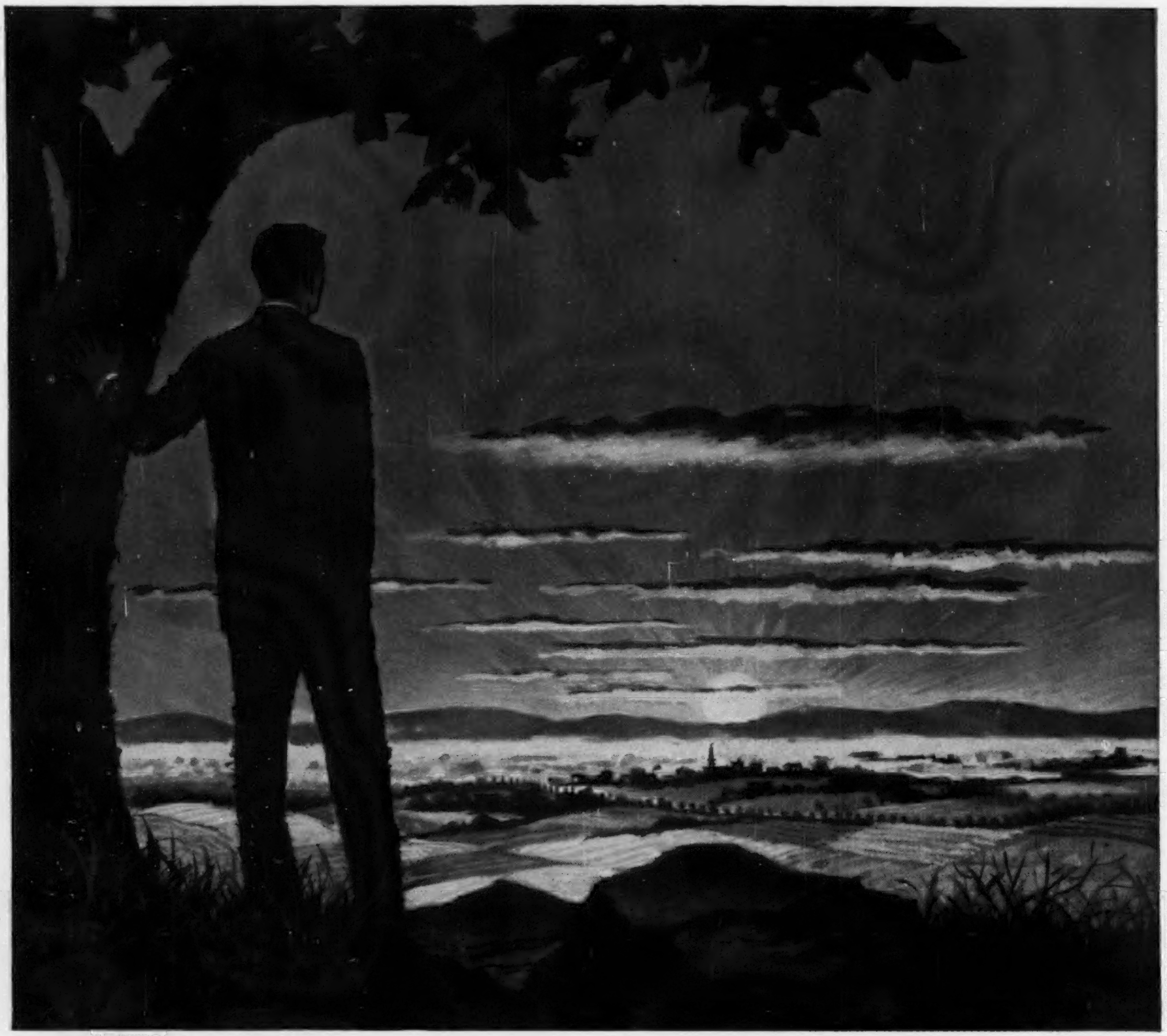
There is the section entitled "New Books" which brings to your attention the latest books being offered by various publishers and other sources which carry information that will contribute to your continuing education. There is the "Manufacturers' Literature" section which calls to your attention the latest offerings of the manufacturers throughout the United States. There is the "New Products" section bringing to your attention the latest equipment available to help you in the satisfactory performance of your responsibilities. There is the "New Bulletins" section advising of information related to agricultural engineering which is published by various colleges, universities, the USDA, various companies and organizations, and certain foreign agencies. There are the "ASAE Meetings Calendar" and the "Events Calendar" advising you of important technical meetings of ASAE and related organizations which might be of interest to agricultural engineers who wish more detailed and current information on a given subject.

There are the important advertising messages bringing product information and techniques to your specific attention through the courtesy of advertisers in our Journal and Yearbook. The section "ASAE Members in the News" enables you to stay abreast of personnel changes and promotions, so that you are aware of the assignments of your ASAE friends — thus expanding your contacts throughout the profession. The section "With the ASAE Sections" advises you of the work and activities of the ASAE sections throughout the United States so that, with a few minutes reading, you can be informed of the progress of your profession, its interests, its contributions, throughout the nation. The timely editorials and special columns ("Report to Readers," "Check Points") bring to you items of current interest to all agricultural engineers. The "Personnel Service Bulletin" allows you to keep your "finger on the pulse" of job opportunities, personnel available, and salaries offered for agricultural engineering services. The section on "Membership Applicants" lets you know who is seeking admission into your organization and gives you an opportunity to exercise your prerogative of expressing yourself concerning the eligibility of any applicant. The "Readers Forum," not too frequently used, is available for you to offer a different viewpoint (if documented) or supplementary information to any paper presented in AGRICULTURAL ENGINEERING. "Research Notes" shares with you certain research activities in progress. The "News Section" brings to you the latest information of special interest to agricultural engineers. Add to this the value of the technical articles carried in each issue of AGRICULTURAL ENGINEERING and you have a monthly package, offered by your professional organization, which is absolutely essential reading for the engineer who wishes to continue his education and development in the field of agricultural engineering.

Supplement all this with the technical articles carried in TRANSACTIONS OF THE ASAE; the product directory, membership roster, standards, recommendations, data, graduate theses, tractor tests, various listings and professional information carried in AGRICULTURAL ENGINEERS YEARBOOK; and the additional knowledge offered to members in the form of technical papers, special committee reports and publications and you have a vast store of information which contributes to the continuing education of the individual.

Finally, consider the technical meetings sponsored by ASAE — national, regional, state, and local — the papers presented at these meetings, the personal contacts made, the exchanges of information, and the experience gained through serving on committees, as section officers, or in presenting papers at such meetings. This is where agricultural engineers develop the ability to present technical information before their peers, develop the ability to lead others and to work cooperatively with others toward the solution of professional and technical problems. All of these things contribute to the development of the individual and therefore to his ability to serve and to his own professional advancement.

These contributions to the continuing education of the agricultural engineer constitute only one of the major functions of an organization such as ASAE, but we submit that this function alone more than justifies the cost of ASAE membership. Are you taking full advantage of these opportunities? Are you taking steps to assure your continued development in the profession of your choice? For the sake of your own professional future, we hope you can answer these questions affirmatively.



RESEARCH NOTES

Brief news notes and reports on research activities of special agricultural-engineering interest are invited for publication under this heading. These may include announcements of new projects, concise progress reports giving new and timely data, etc. Address: Editor, AGRICULTURAL ENGINEERING, St. Joseph, Michigan.

Two Join USDA Agricultural Engineering Research Division

Dale R. Peterson and Elmer E. Jones, Jr., have joined USDA Agricultural Engineering Research Division.

Mr. Peterson, is a graduate of Washington State University and, until recently, a first lieutenant in the U.S. Army Corps of Engineers. He will be stationed at Pullman, Wash., and will work on research on electrically operated and controlled systems for removing silage from horizontal silos. This work is being conducted by the Farm Electrification Branch with the cooperation of the Washington Agricultural Experiment Station.

Mr. Jones, who has transferred from Rocky Ford, Colo., where he worked for the Soil Conservation Service, will study farmstead water supplies for the Livestock Engineering and Farm Structures Research Branch. He is stationed at the University of Maryland at College Park and will work in cooperation with the State Agricultural Experiment Station there.

Yeck Is Named to Two Posts

Dr. Robert G. Yeck, chief of the Livestock Engineering and Farm Structures Branch, AERD, ARS, USDA, has been named United States Liaison Officer with two European documentation centers. The centers provide Europeans with information about farm building activities published in other parts of the world including the United States, Russia, Australia and New Zealand. The centers are sponsored by the European productivity agency of the Organization for European Cooperation.

Dr. Yeck was also named chairman of a committee on the effect of climatic factors on the performance of domestic animals. The committee was recently established under the Agricultural Board of the National Academy of Sciences. ASAE Members Thamon E. Hazen of Iowa State University and Robert E. Stewart, head, Agricultural Engineering Department, Ohio State University also were named to the committee. Other committee members include F. N. Andrews of Purdue University, D. V. Catron of the Walnut Groves Co., R. E. McDowell of USDA and H. D. Johnson of the University of Missouri.

Test Device for Distributing Granules by Aircraft

A radically different method of dispensing granular chemicals from aircraft is being tested by USDA agricultural engineers at Forest Grove, Ore. The new distributor, which is fastened to the underside of the plane's fuselage, consists of a miniature conveyor belt housed in a streamlined attachment somewhat like a small non-lift wing. The device conveys granules from hoppers in the fuselage to desired points along the airfoil, which may have a span of as much as 18 ft. The experimental distributor mechanically conveys granules outboard to the wing-tip vortices while conventional distributors rely on air currents to convey granules away from the center of the aircraft.

Publications on Agricultural Engineering Now Available

The following publications of interest to agricultural engineers are now available by writing to AERD, ARS, USDA, Plant Industry Station, Beltsville, Md.:

"Vibrator Seed Separator" (ARS 42-50) by J. E. Harmond and L. M. Klein.

"Long Fiber Burnishing, Ribboning, and Cleaning Machine" (ARS 42-49) by M. H. Byrom and H. D. Whittemore.

"Mechanical Vibratory Feeder for Small Seed" (ARS 42-51) by J. E. Harmond.

"Experiences in Mechanical Harvesting of Cherries" by H. P. Gaston of Michigan State University, reprinted from the proceedings of the 90th Annual Meeting of the Michigan State Horticultural Society.

"Fiber vs Moisture" by W. E. Garner and J. A. Luscombe, both of AERD, ARS USDA, reprinted from the March 1, 1961, issue of the *Ginners Journal Yearbook*.

"A Study of Castor Bean Harvester Field Losses" (English, German and French) by L. F. Bouse of the Oklahoma Agricultural Experiment Station published in cooperation with AERD, ARS, USDA.

"A Castor Bean Plot Harvester," a part of the Oklahoma State University Process Series, by L. G. Schoenleber.

"Mechanical Harvesting and Handling in the United States," by J. H. Levin, as reprinted from the spring issue of *International Fruit World*.

"For 30 years, USDA Has Aided Cotton Ginners" by C. S. Shaw, AERD, a reprint from the March 18 issue of *The Cotton Gin and Oil Mill Press*.

"Seed Losses in Harvesting Some Grass and Legume Crops in the Willamette Valley, Oregon, 1953-54" (ARS 42-48) by L. M. Klein, J. E. Harmond, and W. M. Hurst, all AERD.

The following bulletins have been released recently. Copies may be obtained by writing to author or institution listed with each.

The following four plan sheets are available from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Price, 5 cents each.

Plan No. 5871 — Poultry House for Laying Hens. USDA Miscellaneous Publication No. 844. May 1961.

Plan No. 5872 — Self-Feeding Fences for Cattle. USDA Miscellaneous Publication No. 846. April 1961.

Plan No. 5873 — Swine Unit for Dry Lot Feeding. USDA Miscellaneous Publication No. 845. May 1961.

Plan No. 5874 — Sheep Shed. USDA Miscellaneous Publication No. 848. May 1961.

Environmental Studies with Early-Weaned Pigs, by A. J. Muehling and A. H. Jensen. Bulletin 670. March 1961. Agricultural Experiment Station, University of Illinois, Urbana, Ill.

Evaluation of Construction, Materials, and Livability of Five Expansible Farmhouses, by Archie A. Biggs and Joan C. Courtless. Bulletin ARS 42-45. April 1961. Agricultural Research Service, USDA, Beltsville, Md.

Methods and Machinery for Cutting and Cleaning Irrigation and Drainage Channels. Farm Power and Machinery Informal Working Bulletin 13. Food and Agriculture Organization of the United Nations. Available from Columbia University Press, International Documents Service, 2960 Broadway, New York 27, N. Y.

The following three reprints are available from Michigan State University, East Lansing, Mich.:

Basic Data Related to the Drying of Ear Corn, by Stanislaw Pabis and Carl W. Hall. Article 43-81, May 1961. Reprinted from the *Quarterly Bulletin* of the Michigan Agricultural Experiment Station, MSU, East Lansing, Vol. 43, No. 4, pages 766-72, May 1961.

Experiments in Thinning Peaches with Machines — A Progress Report, by H. P. Gaston, Scott Hedden, and J. H. Levin. Article 43-80, May 1961. Reprinted from the *Quarterly Bulletin* of the Michigan Agricultural Experiment Station, MSU, East Lansing, Vol. 43, No. 4, pages 756-65, May 1961.

Practical Hydrologic Concepts Concerning a Small, Michigan, Agricultural Watershed, by Earl A. Myers and E. H. Kidder. Article 43-78, May 1961. Reprinted from the *Quarterly Bulletin* of the Michigan Agricultural Experiment Station, MSU, East Lansing, Vol. 43, No. 4, pages 743-50, May 1961.

The following three bulletins are available from the Institute for Land and Water Management Research, Wageningen, The Netherlands:

The Agro-Hydrological Survey of the Netherlands, by W. C. Visser. Technical Bulletin 19. 1961.

Hydro-Geological Investigations in the Netherlands, by N. A. De Ridder. Technical Bulletin 20. 1961.

Exploration and Exploitation of Shallow Fresh Water Layers in Coastal Areas, by J. A. Van't Leven. Technical Bulletin 21. 1961.

The following four test reports are available from the Agricultural Machinery Administration, Province of Saskatchewan, Department of Agriculture, 7th and Hamilton Sts., Regina, Saskatchewan, Canada:

Bazooka Battery Powered Truck Unloader. No. 1760. May 1961.

Brandt Grain Loader. No. 1860. May 1961.

Radson Model TR-30 Transistor Moisture Meter. No. 1960. May 1961.

Quicktest Type QT2 Grain Moisture Tester and Hygrometer. No. 2060. May 1961.

The following two publications are available from the Information Division, Canada Department of Agriculture, Ottawa, Ontario, Canada:

Soil Erosion by Water, by P. O. Ripley, W. Kalbfleisch, S. J. Bourget, and D. J. Cooper. Publication 1083. May 1961.

Pesticide Research Institute Research Report — 1957-1960.

The following two publications are available from the Department of Engineering Science, Ontario Agricultural College, Guelph, Ontario, Canada:

Survey of Pump Drainage Installations in Ontario—1957. Eng. Tech. Publ. No. 3. 1960.

Research Summaries. Eng. Tech. Publ. No. 4. July 1961.

The following four publications are available from Farm Machinery Research Institute, Orlay utca 1, Budapest, XI, Hungary:

Investigations on Soil Cultivation Implements for Large Scale Orhard Farms, by Kalman Lammel. No. 3. 1960. Summary in English.

Comparative Examination of Milking-Parlour Equipment, by Gyula Banhazi and Emil Aradi. No. 4. 1960. Summary in English.

Investigation on the Chaffing Method of Grain Harvesting, by Daniel Jovan and Jeno Majkuth. No. 5. 1960. Summary in English.

Investigation of Overhead Irrigation Equipment, by Ferenc Hofmeister. No. 6. 1960. Summary in English.

The following four test reports are available from the National Institute of Agricultural Engineering, Wrest Park, Silsoe, Bedfordshire, England:

Track Marshall 70 Diesel Crawler Tractor (pre-production). No. 273/BS. August-September 1960.

"Atko Teleplastic" P. T. O. Safety Guards. No. 274. March 1961.

Fordson Power Major Diesel Tractor. No. 275/EA. January 1961.

Landmaster "L.150" Rotary Cultivator. No. 276/EA. January 1961.

Agricultural and Horticultural Engineering Abstracts. Vol. XII, No. 2. 1961. Abstracts 442-890. National Institute of Agricultural Engineering, Wrest Park, Silsoe, Bedfordshire, England.

Poultry Respiration Calorimetric Studies of Laying Hens, by Hajime Ota and E. H. McNally. ARS 42-43. June 1961. Agricultural Research Service, USDA, Beltsville, Md.

Report on Objective Criteria in Nuclear Engineering Education — 1960-61. Professor W. Leighton Collins, secretary, American Society for Engineering Education, University of Illinois, Urbana, Ill. Price, 25 cents for individual copies; quantity prices on request.

Ponds for Work and Fun. Extension Bulletin E-374. January 1961. Cooperative Extension Service, Michigan State University, East Lansing.

Irrigation Efficiency Studies, prepared by Carrol L. Tyler and G. L. Corey. Idaho Agricultural Research Progress Report No. 55. May 1961. Agricultural Experiment Station, University of Idaho, Moscow.

Commercial Standard CS45-60, Douglas Fir Plywood. Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Price, 15 cents.

List of ASTM Publications. April 1961. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

New Developments in Forest Fire Control Applicable to Grass and Brush Fires, by Robert F. Wagle. Special Report No. 9. Agricultural Experiment Station, The University of Arizona, Tucson.

Hot Weather Shelter for Lactating Dairy Cattle, by Gordon L. Nelson, George W. A. Mahoney, and Ernest R. Berousek. Technical Bulletin T-87. June 1961. Agricultural Experiment Station, Oklahoma State University, Stillwater.

Results of Research in 1960 by the Kentucky Agricultural Experiment Station. 73rd Annual Report of the Director. Agricultural Experiment Station, University of Kentucky, Lexington.

Scheduling Irrigation from Pan Evaporation, by M. C. Jensen, J. E. Middleton, and W. O. Pruitt. Stations Circular 386. May 1961. Washington Agricultural Experiment Stations, Washington State University, Pullman.

A Bibliography of Farm Buildings Research — 1945-1958 — Part V, Buildings for the Drying and Storage of Grain. Agricultural Research Council, Cunard Building, 15 Regent St., London, S.W. 1, England. Price, 3s. 6d. by post.

The following is a list of recent applicants for membership in the American Society of Agricultural Engineers. Members of the Society are urged to send information relative to applicants for consideration of the Council prior to election.

Cecil, Brice W. — Marketing asst., American Petroleum Institute, 1271 Avenue of Americas, New York 20, N. Y.

Coleman, William S., Jr.—Chief admin. engr., Eng. Res. and Dev. Div., Motec Industries, Inc., Hopkins, Minn.

Cordes, Hugh B. — Asst. des. engr., Towner Mfg. Co. (Mail) 10601 Linnell, Garden Grove, Calif.

Cornell, Barry F.—Asst. chief engr., Howard Rotovator Co., Inc., Box 206, Harvard, Ill.

Dodson, Howard — Dist. mgr. and ind. rep., Kengas, Inc., P.O. Box 187, Jefferson Town, Ky.

Edgerton, T. R. — Pres., T. R. Edgerton Co. (Mail) 8900 Holmes, Kansas City 31, Mo.

Feightner, John O. — Owner, Central Florida Pump and Equipment. (Mail) P.O. Box 3741, Orlando, Fla.

Foud, Hassan A. H. H. — Farm mgr., The Permanent Organization of Land Reclamation. (Mail) 18 kasv El Aini St., Cairo, Egypt, U.A.R.

Gordon, John F. — Farm div. coordinator, Lubrication Engineers, Inc., P.O. Box 7128, Fort Worth, Texas

Hayashi, Terutake — Dir. and chief, tech. div., Toyohira Farm Machinery Mfg. Co., Ltd. (Mail) 3-2, No. 25, Konohanadanchi, Hiragishi, Toyohira-cho, Sapprocity, Hokkaido, Japan

Howe, David J. — Trainee, Eastern States Farmers Exchange, Inc. (Mail) 25 Marble Ave., Rutland, Vt.

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McLeod, Herbert E. — Assoc. prof., agr. eng. dept., Clemson College, Clemson, S. C. (Associate Member to Member)

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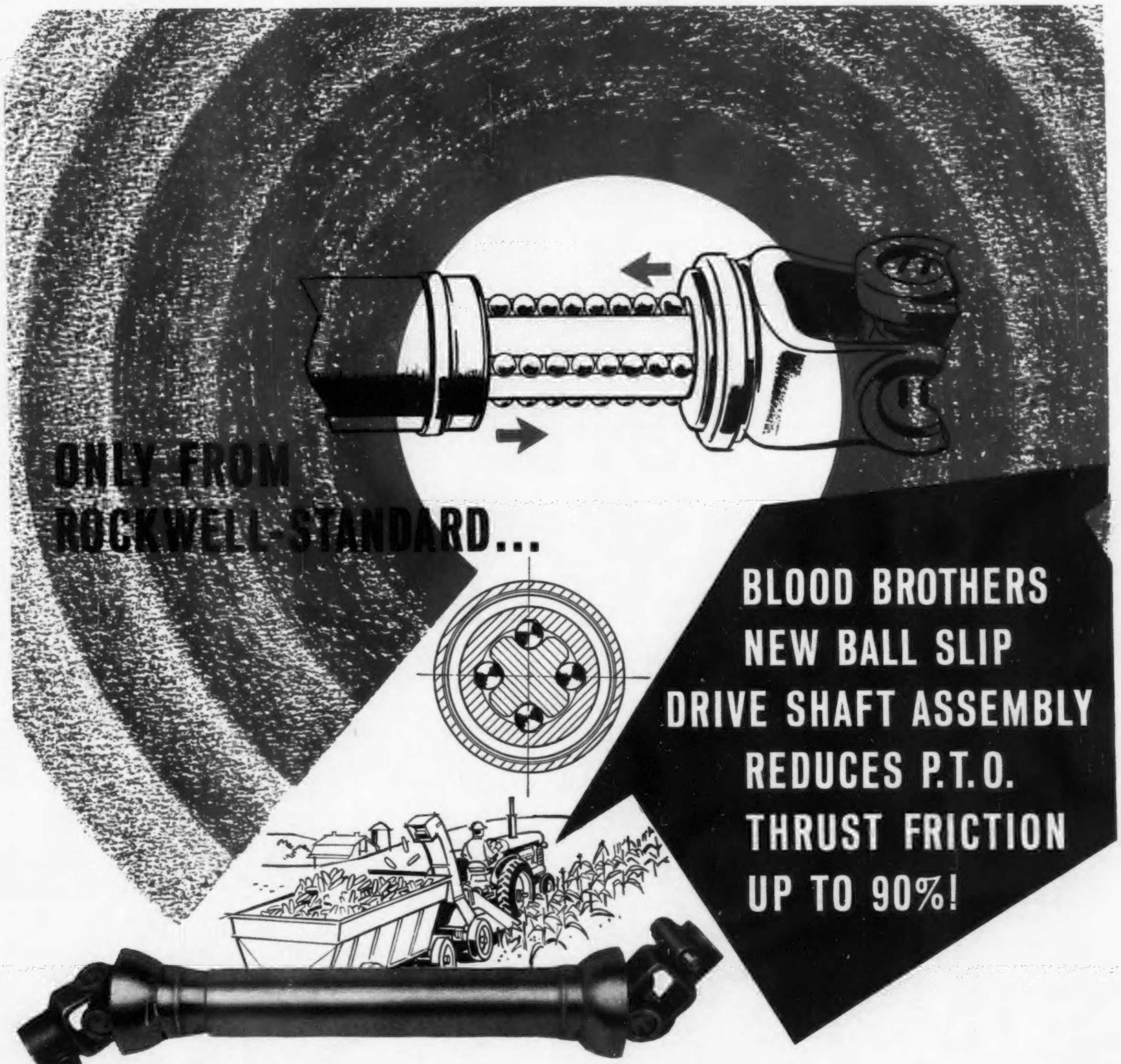

Farm equipment today is bigger, bulkier, heavier than ever. As a result, tractor P.T.O. drive shaft assemblies are subjected to hours of rugged use and abuse. When it comes to wear like this, spline shaft drives just can't take it! Edges become burred, rough, worn. Shafts get "locked" in place. P.T.O. bearings often break.

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Rockwell-Standard engineers have successfully solved the problem with an exclusive new Ball Slip Assembly that *reduces P.T.O. thrust friction up to 90% compared with spline type shafts for longer wear, more dependable service.* Several series of metal balls are held in grooves between the inner and outer shafts. This minimizes total metal-to-metal contact, keeps shafts "sliding smooth" for easy movement, improved wear-ability, trouble-free operation.

The unique Blood Brothers Ball Slip Assembly is proving itself in daily use. Many of the nation's leading farm equipment manufacturers have specified it for their units. It is typical of the new product developments that come from the continuing research of Rockwell-Standard engineers. Their designing skill and production experience have brought greater efficiency and economy to every major field of industry. Let them prove what they can do for you!

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PERSONNEL SERVICE BULLETIN

Note: In this bulletin the following listings current and previously reported are not repeated in detail. For further information, see the issue of AGRICULTURAL ENGINEERING indicated. "Agricultural Engineer" as used in these listings is not intended to imply any specific level of proficiency or registration as a professional engineer. Items published herein are summaries of mimeographed listings carried in the Personnel Service, copies of which will be furnished on request. To be listed in this bulletin, request form for Personnel Service listing.

Positions Open – February – O-11-101, 13-102, 35-104. **March**–O-67-107, 76-108, 77-109, 71-112. **April**–O-95-117, 155-118, 163-119. **May**–O-189-120, 198-121, 199-122, 212-123, 218-124, 226-125. **June**–O-257-126, 257-127, 265-128, 259-129. **July** –O-284-130, 286-131, 293-132, 294-133, 294-134.

Positions Wanted–February–W-8-1, 21-2, 22-3, 29-5, 16-6, 30-7, 34-8. **March**–W-58-11, 56-12, 75-14. **April**–W-112-17, 135-18, 142-19, 115-20, 160-21, 161-22, 164-24, 166-26, 171-27, 178-28. **May**–W-187-29, 190-30, 97-31, 200-32, 201-33, 202-34, 203-35, 204-36. **June**–W-244-37, 236-38, 264-39, 247-40. **July**–W-228-41, 213-42, 285-44, 280-45, 290-46, 219-47, 245-48, 287-49, 296-50.

NEW POSITIONS OPEN

Agricultural Engineer (instructor) for teaching farm tractors, power and machinery in a western state college. Related advisory work with students, and cooperation with other departments on equipment selection and management for college farm. Age 25-35. BSAE with emphasis on power and machinery. Additional graduate training desirable. Farm background, college teaching, and farm equipment operating or service experience desirable. Ability and interest in teaching. Agreeable personality. Able to cooperate and get along well with others. Initiative and enthusiasm to continue development of an outstanding program. Position open now. Salary; junior instructor $5628-$6840; intermediate instructor $6204-$7536. O-309-135

Agricultural Engineer for extension work in farm structures with a north central state university. Thorough undergraduate training in functional and structural design of farm buildings essential. Advanced degrees desirable, but may take work for advanced degree on job. Farm background essential, preferably dairy farming in North Central Region of United States. Age range – 22 to 40 years. Good fringe benefits. Excellent opportunities for promotion. Salary range $5,700 to $10,500 for 12 months with one month vacation. Salary will depend upon age, training and experience. O-310-136

Agricultural Engineer for senior design engineer position with western manufacturer of row-crop harvesting equipment. Will work as direct assistant to product engineer, especially in design, preparing layout drawings, supervising junior engineers in preparation of shop detail drawings, and in field testing. Age 26-35. BSAE, or equivalent. Three plus years in design of farm machinery. General knowledge of production equipment and methods. Good knowledge of mechanics. Creative ability. Prefer married man with good health, good personal habits, and ability to work well with others. Opportunity for advancement to senior product engineer, or higher for man showing executive ability. Salary open. O-329-137

Agricultural Engineer for field test work on test farm in South for major full-line manufacturer of farm equipment. BSAE, or eqivalent. Five years direct field test experience on farm and/or industrial equipment. Usual personal qualifications for engineering in industry. Opportunity up to individual. Excellent fringe benefits. Position now open. Salary open. O-334-138

Agricultural Engineer (lecturer or assistant lecturer) for teaching and research in farm machinery and other branches of agricultural engineering at the University of Malaya in Kuala Lumpur. BSAE, or equivalent, preferably with honors. Prefer man with some previous experience in tropical agriculture, and in teaching or research. Usual personal qualifications for public service. Man selected will have opportunity to help develop newly authorized facilities and course work. Closing date for receipt of applications Sept. 30, 1961. Salary open. O-337-139

Agricultural Engineer for research (75%) and teaching (25%), in the soil and water field, with a northwestern state university. Age 27-45. MS or PhD from an accredited department of agricultural or irrigation engineering. Special interest, training and experience in drainage. Good health, initiative, dependability, and resourcefulness. Professional interest in teaching and research. Able to work with people. Opportunity to take a limited amount of graduate work each term. Annual basis, one month vacation with pay. Retirement provisions. Salary open. 0-341-140

NEW POSITIONS WANTED

Agricultural Engineer for extension, teaching, or research in rural electric or irrigation field, with industry or public service western U.S.A. Married. Age 25. No disability. BSAE, 1959, Washington State University. Farm background, including 8 summers work on wheat ranch. Two summers work in irrigation research. Commissioned service in Army Corps of Engineers, two years to be completed in September. Available Oct. 1. Salary open. W-181-51

Agricultural Engineer for design, development, research or management in power and machinery with manufacturer or consultant in Northwest, West, or Midwest. Married. No disability. BSME expected in November. Farmed and fed cattle 12 years, in partnership. Additional experience in machinery sales and in machine shop. Particularly interested in experimental design of agricultural machinery, especially forage planting, tillage, harvesting, materials handling, and power use. Available in December. Salary $8,500. W-306-52

Agricultural Engineer for design, development, or research in power and machinery, in technical aid program in Near, Middle, or Far East. Prepared to travel. No disability. BA, 1956, Punjab University. BSA, 1961, University of British Columbia. MSA expected 1963, University of British Columbia. Three summers work as research assistant on irrigation research project of Department of Agriculture, Canada. Available May 1963. Salary $500 per month. W-307-53

Agricultural Engineer for development or research in power and machinery or soil and water field with industry or public service in South or Midwest. Married. Age 30. Corrected vision. BSAE expected in August, Mississippi State University. Several years experience in management of 700-acre farm, including maintenance of machinery and supervising farm labor. Military service 2 yr in military police. Available Sept. 1. Salary $500 per month. W-303-54

Agricultural Engineer for sales, service, writing or management in any field of agricultural engineering, with industry. Any location. Willing to travel. Single. Age 27. Corrected vision. BSAE, 1956, A & M College of Texas. Varied experience in U.S. Patent Office, as manager of small business, agricultural census enumerator, building maintenance materials and home improvement sales, and roofing contractor trainee. Army service in AG operations, and Finance and Accounting. Available on reasonable notice. Salary open. W-305-55

Agricultural Engineer for design, development, or service in power and machinery or farm structures with manufacturer or consultant. Any location. Married. Age 29. No disability. BSAE, machine design option, 1956, Louisiana State University. Farm background. Student work part time as draftsman, and engineering aid. Free lance house designing 2½ yr part time. Junior engineer 7 mo. with aircraft manufacturer. Active commissioned service in USAF 4 yr, with pilot rating. Also hold commercial single and multi-engine pilot's license with instrument rating. Available now. Salary $600 per month. W-304-56

Agricultural Engineer for development, extension teaching or writing, in farm structures, soil and water or agricultural applications of plastics with manufacturer, distributor, consultant, trade association, or college, West Coast or Upper Great Lakes location. Limited travel. Married. Age 39. No limiting defects. BSA with major in agricultural engineering, 1949, Oregon State University. One year graduate study in agricultural engineering, Washington State University. Irrigation system design and sales engineering; also design of machine to manufacture couplers, 4 yr. County agent in irrigation, Columbia Basin Irrigation Project, 7 years. War non-commissioned service in Air Force. Available Sept. 1. Salary $7,500. W-323-57

Agricultural Engineer for design, development, extension, or research in farm structures or power and machinery with college, federal agency, manufacturer, processor, or trade association. Any location. Married. Age 24. No disability. BSAE, 1959, Iowa State University. MSAE expected May 1962, Oklahoma State University. Both FS & PM options completed at BS level; FS option at MS level. Farm background. Summer work with test section of tractor manufacturer. Testing crop driers, 5 months, with manufacturer. Active commissioned service, Corps of Engineers, heavy equipment maintenance, 6 mo. Available Feb. 1962. Salary open. W-317-58

Agricultural Engineer for design, development or research in power and machinery with manufacturer. Northern US or Canada preferred. Willing to travel. Single. Age 28. No disability. BS in Engineering (Mechanical option) 1956. Practical experience 3 yr. in design, assembly, and testing of tractors and diesel engines. One year of research in agricultural machinery. Available on reasonable notice. Salary open. W-318-59

Agricultural Engineer for design, development or research in soil and water field with public service agency or consultant. Anywhere in USA. Interested in work for graduate degree. Married. Age 26. No disability. Graduate diploma in mechanical engineering, Sydney Technical College (Australia). Experience 6 years as design and detail draftsman, while studying at night. College teaching 1½ yr, in soil conservation structures, surveying and leveling, and elementary agricultural engineering. Available Jan. 1962. Salary open. W-330-60

Agricultural Engineer for teaching, sales, service, writing, or management in power and machinery or product processing, with manufacturer or trade association, preferably in Michigan. Will move for right work. Married. Age 39. Slight hearing defect. BSAE, 1948, Michigan State University. Nine years with major farm equipment manufacturer in progressively more responsible work in sales, service, sales management, sales training, and market analysis. War non-commissioned service in Army 4 years. Available Sept. 1. Salary $9,000 - $12,000 range. W-331-61

Agricultural Engineer for design, development or research in power and machinery or rural electric field, with manufacturer, processor, or farming operation, anywhere in U.S.A. Married. Age 26. No disability. BSAE 1957, Auburn University. Active commissioned military service in Armored unit, 2 yr. Approximately one year experience in design with farm equipment manufacturer. Available on reasonable notice. Salary open. W-302-62

. . . News

(Continued from page 440)

Industrial class the "Motion Picture" award went to U.S. Steel Corp. for "Modern Trends in Swine Production."

Under "Demonstration Models" in the Public Agency class the winners were "Beef Layout," Iowa State University, and "Swine Finishing Buildings," Iowa State University. In the Industrial class the "Demonstration Models" winner was U.S. Steel Corp. for a "Dairy Layout."

. . . Events Calendar

(Continued from page 438)

Dallas, Texas. Details may be obtained from AWS, 33 W. 39th St., New York 18, N. Y.

September 25-28 — *Industrial Building Exposition and Congress,* New York Coliseum, New York, N. Y. Contact Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y. for details.

October 4-6—*1961 Annual Meeting, Southern Farm Equipment Manufacturers,* Ponte Vedra Beach, Fla. For details write to SFEM, P.O. Box 9, Chamblee, Ga.

October 16 — *Annual Meeting of the American Society of Safety Engineers,* observing its 50th anniversary, Waldorf Room, Conrad Hilton Hotel, Chicago, Ill. Details may be obtained from ASSE, 5 N. Wabash Ave., Chicago 2, Ill.

October 19 — *Fifth International Course in Hydraulic Engineering,* Delft, Netherlands (for eleven months). Information may be obtained from Netherlands Universities Foundation for International Co-Operation, 27 Molenstraat, The Hague, Netherlands.

October 19-20 — *1961 National Conference on Industrial Hydraulics,* Sherman Hotel, Chicago, Ill. Information may be obtained from Illinois Institute of Technology, 35 W. 33rd St., Chicago 16, Ill.

October 20-22 — *Eastern Lawn and Garden Trade Show,* New York Coliseum, New York, N. Y. Write to ELGTS, Suite 1103, 331 Madison Ave., New York 17, N. Y., for information.

October 22-25 — *Centennial Nutrition Conference,* Hotel Muehlebach, Kansas City, Mo. Contact Midwest Feed Manufacturers' Association, 20 W. Ninth St. Bldg., Kansas City 5, Mo., for details.

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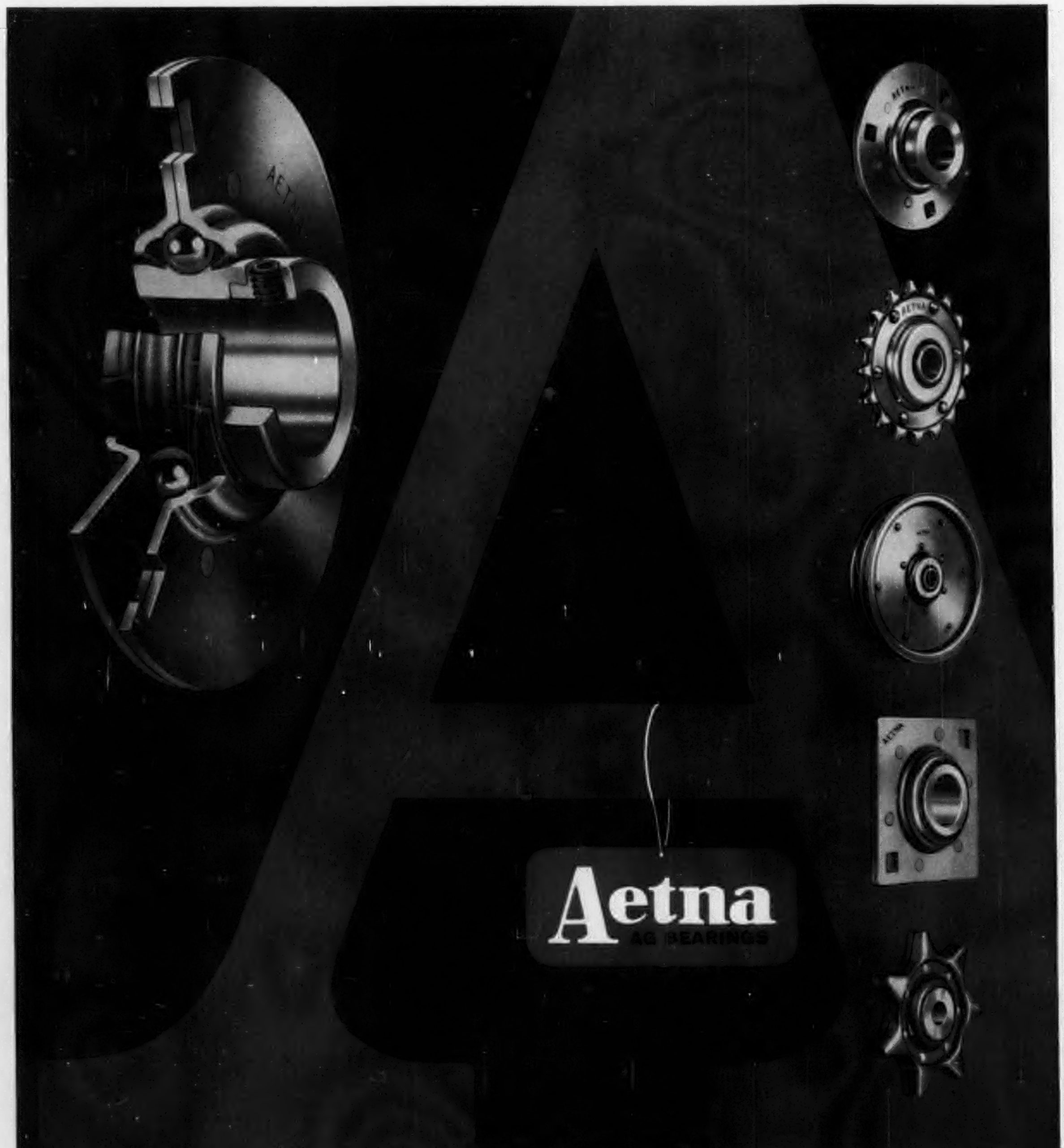

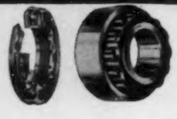

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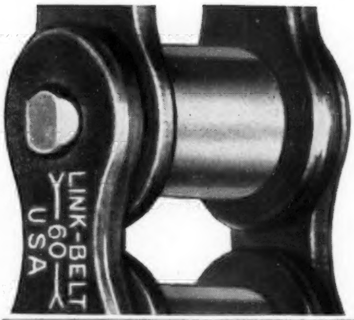

LINK-BELT drive and conveyor chains

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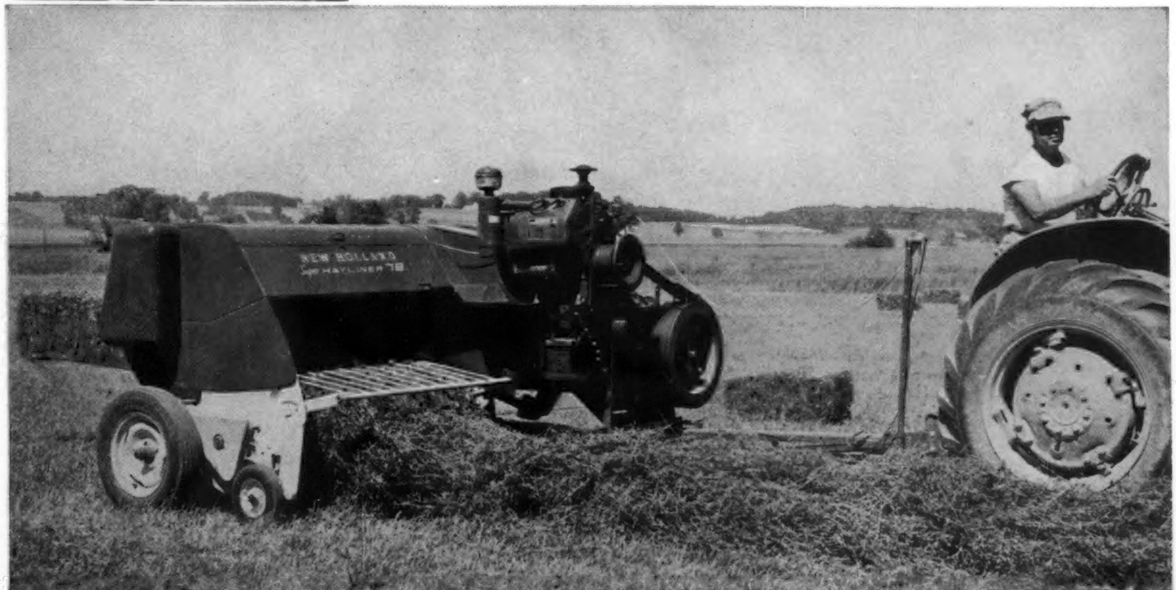

NEW HOLLAND SUPER HAYLINER 78 engine model hay baler gets dependable, positive, all-weather service from both Link-Belt standard-pitch precision steel roller chain and double-pitch agricultural chain.

Over 300 quality-conscious farm machine manufacturers rely on Link-Belt for chain . . . and bonus services besides

If you want chain that's the efficiency-equal of your equipment, join the more than 300 leading manufacturers who go with Link-Belt. Experience has shown them that the refinements built into Link-Belt chain make a vast difference in field performance, help assure customer satisfaction for their machines.

Standard-pitch Link-Belt roller chain, shown at left, is a popular choice for transmitting power on such equipment as hay balers. It features high hp capacity and light weight . . . has consistent quality and uniformity in every link.

Link-Belt offers industry's most complete line of drive and conveyor chains, conveyor chain attachments and sprockets. Also, "bonus" services: application counsel, field analysis, laboratory service and others. These services multiply the *value* of Link-Belt chains, *but not the price!* Contact your nearest Link-Belt office or the Indianapolis plant at 220 S. Belmont Ave. Ask for 640-page Catalog 1050.

IMPORTANT! Link-Belt roller chains for the agricultural field are *true* roller chains. They have *free-turning* rollers. Hence, longer life for chain and sprocket because there's no scrubbing or sliding over sprocket teeth.

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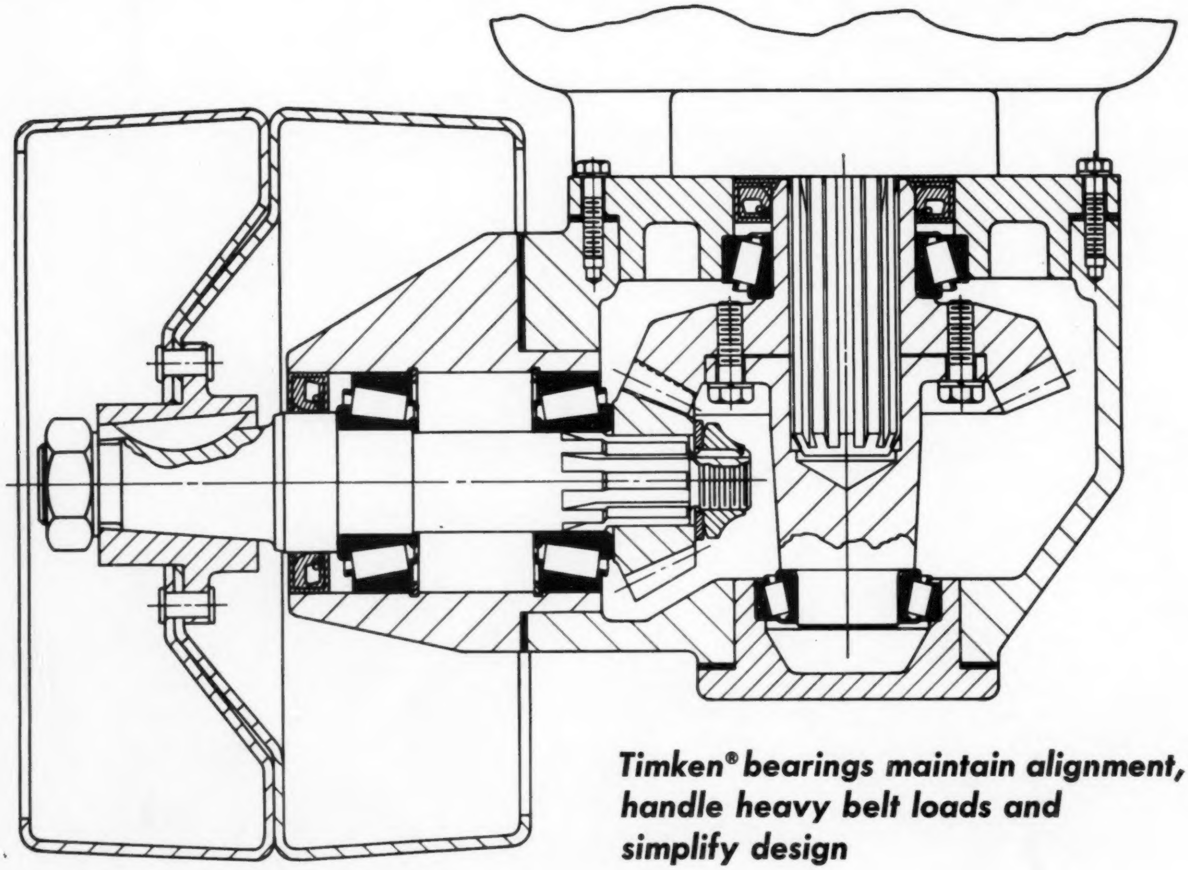
J. I. Case design for tractor belt pulley features less maintenance, easy on, easy off



Timken® bearings maintain alignment, handle heavy belt loads and simplify design

FOR J. I. Case engineers designing an easy-to-mount belt pulley, simplicity was the keyword. They found their answer in Timken® tapered roller bearings. Four Timken bearings kept the design compact and simple while holding gears and shafts in accurate alignment.

The four Timken bearings, as shown in the above diagram, handle the heaviest belt and gear loads in any radial and thrust combination. And full-line contact between Timken bearing rollers and races meant extra load carrying capacity.

Now in the field, the J. I. Case rear-mounted belt pulley for driving blowers and hammer mills, is completely detachable and has the advantage of self-contained lubrication. The fact that the unit need not be re-lubricated every time it is used has solved one of the farmers' biggest maintenance problems.

More and more farm equipment manufacturers are choosing Timken bearings for their machines to assure design simplicity, top performance and freedom from maintenance. And Timken bearings answer the three big problems of agricultural engineers: 1) combination loads; 2) dirt; and 3) ease of operation.

Timken Company Sales Engineers are trained to solve your bearing problems. Call them in. They have the experience and available testing facilities to make their services valuable. Write today for information: The Timken Roller Bearing Company, Canton 6, Ohio. Cable: "TIMROSCO". *Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits.* Canadian Division: Canadian Timken, St. Thomas, Ont.

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